JUNE 26, 1961
Volume 50, No. 13

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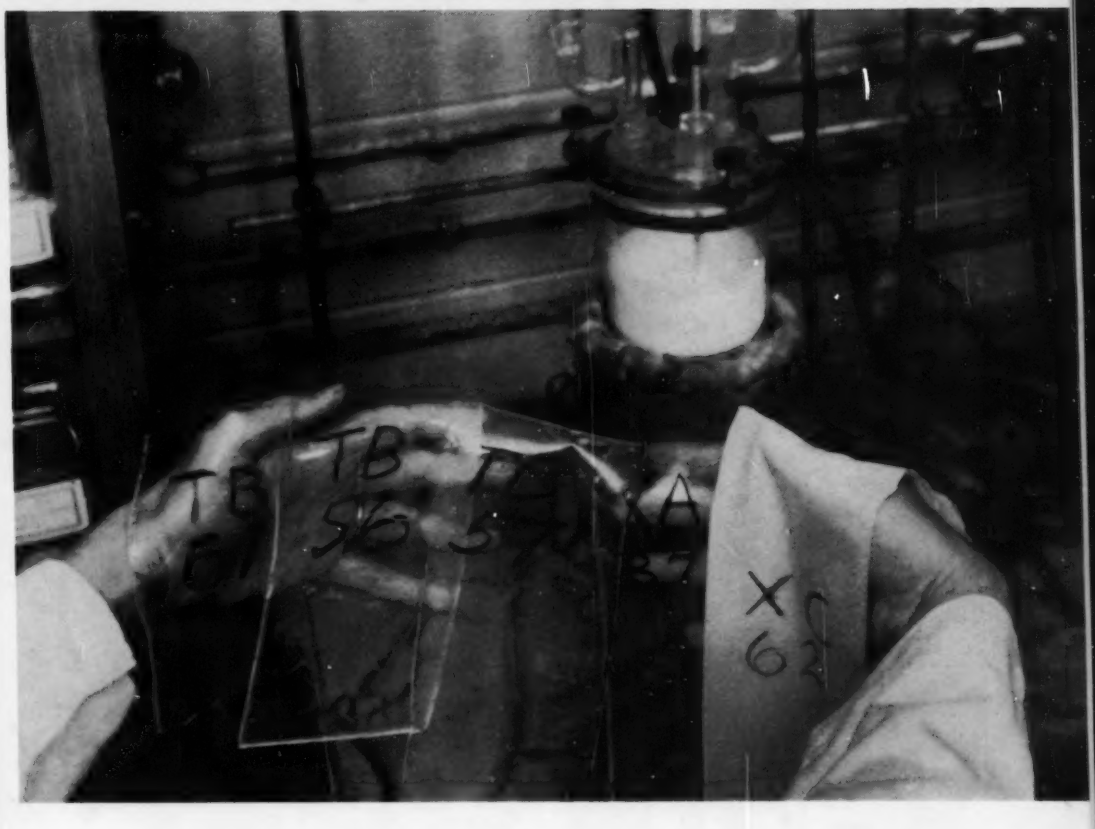
OFFICIAL PUBLICATION OF THE PROCEEDINGS AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

AMERICAN DYESTUFF REPORTER

TEXTILE WET-PROCESSING



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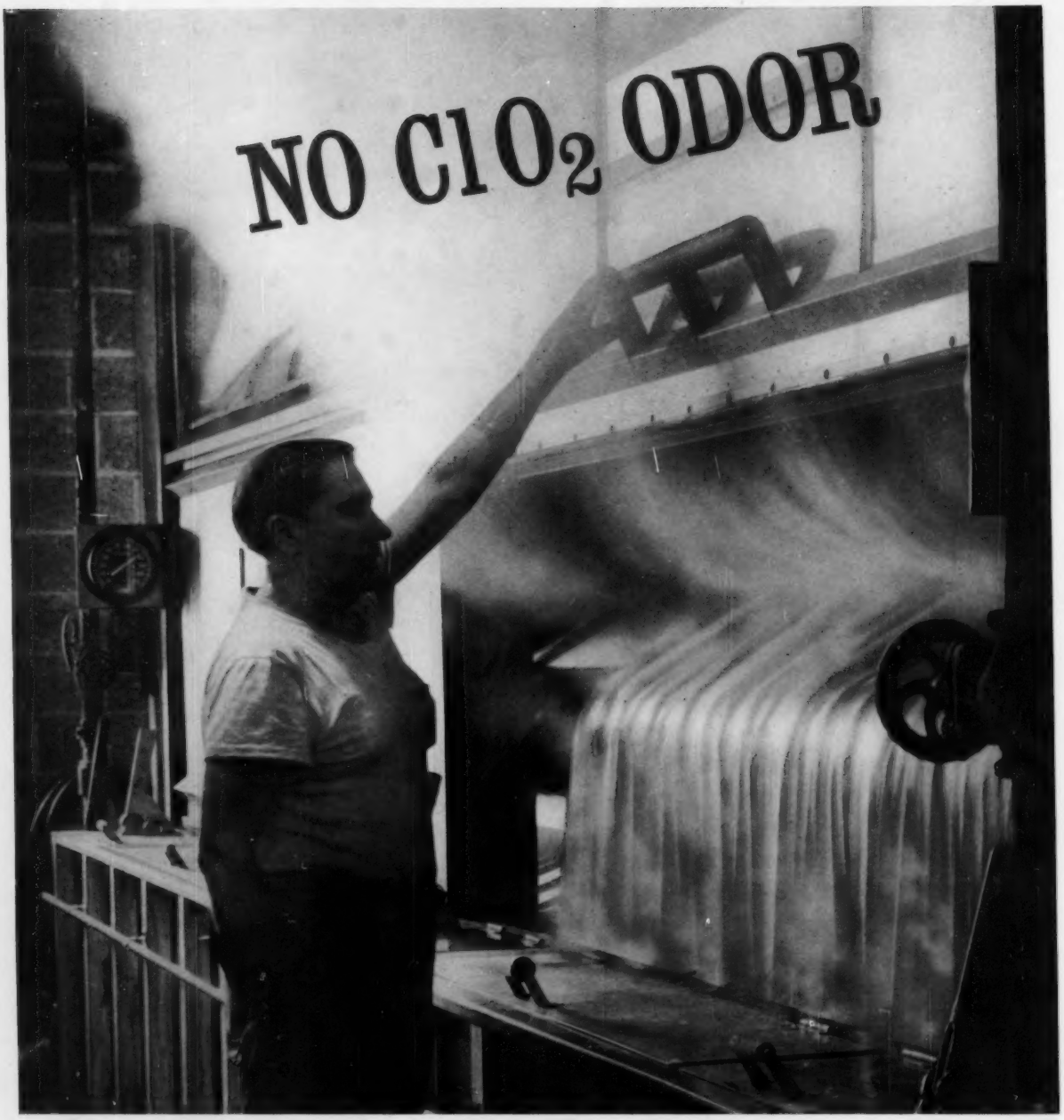

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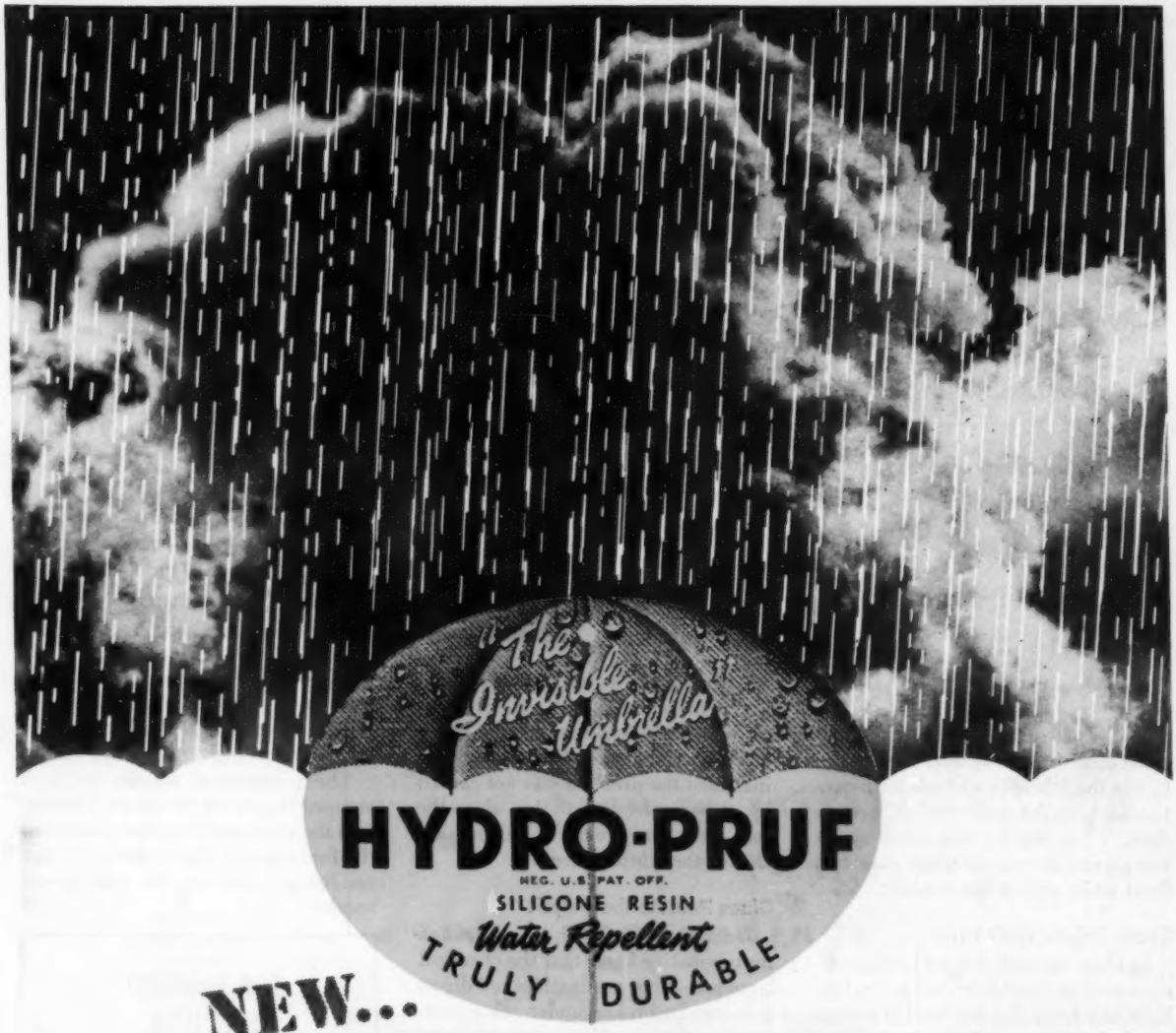

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The Subject for June

The Case of the Tarry Specks

A careful analysis of dyeing procedures unearthed clues that helped solve a mysterious dyeing problem

A well-known dye works in Northern New Jersey recently ran a large volume of triacetate/cotton fabric in a royal blue shade. The dyer had chosen to dye the fabric in a single bath containing both the direct and the acetate dyes. When the lot was on-shade, it was given a simple hot water rinse and fixed while still in the dye box.

Spots Before Their Eyes

In about one out of three lots, specks appeared on the fabric during drying. Both the head finisher and the dyer concluded that one of the acetate dyes, Eastman Blue GP, was tarring out—that large particles of the dye were clinging to the material and, during the heat of finishing, were decomposing. Following this line of reasoning, the dyer switched to another manufacturer's blue. First lot looked fine. Second lot—specks!

At this point, the dyer decided he needed help and called in an Eastman Technical Representative.

Was the Acetate Dye Responsible?

Within the hour, an Eastman man was on the scene following a lot through the complete dyeing and finishing operation. Nowhere in the dyeing process itself was there any evidence of specking. Only after the fabric had gone through the finishing range could the specks be detected. And the man from Eastman reluctantly agreed that they certainly looked like tarred dye formations.

Then, acting on a hunch, the Eastman representative took a piece of the finished fabric and treated it in an acid bath. *The specks disappeared.* This indicated the problem was not caused by undispersed acetate dye, since the acid treatment would not then have cleared the fabric so readily.

Clues Point to the Culprit

On the other hand, the Eastman representative knew that the chemical bond between some fixatives and direct dyes can be broken under acidic conditions, thus implicating those components as the probable source of the specking problem.

In order to pinpoint the problem, however, another dyeing run was begun. Eastman Blue GP was again used but the procedure was changed to include a thorough rinse in a hot salt solution immediately after dyeing. This time *no specks appeared* after the finishing.

Salt Bath Did the Trick

During a more detailed study of the problem, it was found that the fabric underwent considerable fibrillation during the rinsing cycle. The direct dye that bled into the rinse water combined with the fixative when the latter was added to the bath. The reaction of fixative and dye produced a residue, some of which was picked up by the bits of fiber. These particles, being the same color as the fabric itself, were not distinguishable as they clung to the fabric's surface. But when the fabric went through the finishing range, the heat caused the gummy residue to decompose, leaving tarry specks visible.

The presence of salt in the bath stopped the direct dyes from bleeding into the rinse and therefore prevented the formation of dye residue. No dye residue—no pick-up. No pick-up—no specks.

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specially contributed

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R Katherine Taube, Enid S Ross and Nada D Poole

aatcc proceedings

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ADR OPEN FORUM

June 26, 1961

LETTERS TO THE EDITOR

Dear Editor:

"Aren't we funny ones?". Indeed I admired the little story in your May 1 "Open Forum," which involves problems of world-wide consequences. Hence the reason I was tempted to accept your invitation to send in readers views.

Compared with the USA, Norway is underdeveloped in the industrial sense, and I believe that the output generally is lower, since rationalization in this country is lagging behind. But our wage level is lower. Textile workers may earn on the average about N kr 4 to N kr 5 (or 56-70¢ US), which is generally less than in engineering and other industries. Still it places the efficient and rationalized Norwegian firm at an advantage compared with the average or below-average American firm. A possibility for export!

On the other hand, compared with many other countries with less-developed industry and lower wages and expenses, Norway is suffering the same inconveniences—and therefore the US still more.

The only way which appears open, if we do not like to lower our standard of living and believe in world-wide human equality and right, is to continue to help the other peoples to raise their standard of living up to the heights which we have, giving them opportunity to pay the workers the same wages as we do. And this must be done by exporting technical, economical and political know-how, increasing the level of education and planning over the frontiers.

The evolution will come probably in all cases whether we help it or not, but if this assumption is correct, it must be judged wiser to help the development and to lead it, than to struggle against it by legislative restrictions. But to sacrifice our own industry, or any part of it, would not any more render justice to those who are struck by the torrent of the changing economic life.

A method must be found to prevent nationally and internationally harmful economic disasters, equally damaging for the proprietors, workers, credit-holders and the state, probably by active advising in time, help for conversion and reestablishment, perhaps with an altered production. This kind of solidarity between competitors and industries should be inspired.

The continuation story in oversimplification is thus the two-way method of helping the poorer ones to become equal with ourselves and declare universal solidarity with fellow helpers to avoid unjust punishment.

Alf Knag d y
Textile Engineer
Bergen, Norway

Editor's note: Our thanks to reader Knag for his views. His use of the word "rationalization" is probably less better known in the USA than is the term "cost control".

•

Dear Editor:

In the May 15th "Open Forum" you asked for views of readers with regard to whether we would prefer to see more papers with the tables in a condensed version or fewer papers complete to the last detail. I am manager of a research and development laboratory and believe that it would be more helpful to see a larger number of papers with the tables in a condensed version since, if we were interested, we could request more information along with our own comments. Many items which might be bypassed due to the pressure of available space would undoubtedly be found to be helpful and make your magazine more worthwhile to a larger portion of its readers.

Floyd E Colvin
Laboratory Manager
Research and Development Dept
The Cuno Engineering Corp
Meriden, Conn

Editor's Note: Chalk up one vote for the condensed versions. Any others to be heard from?

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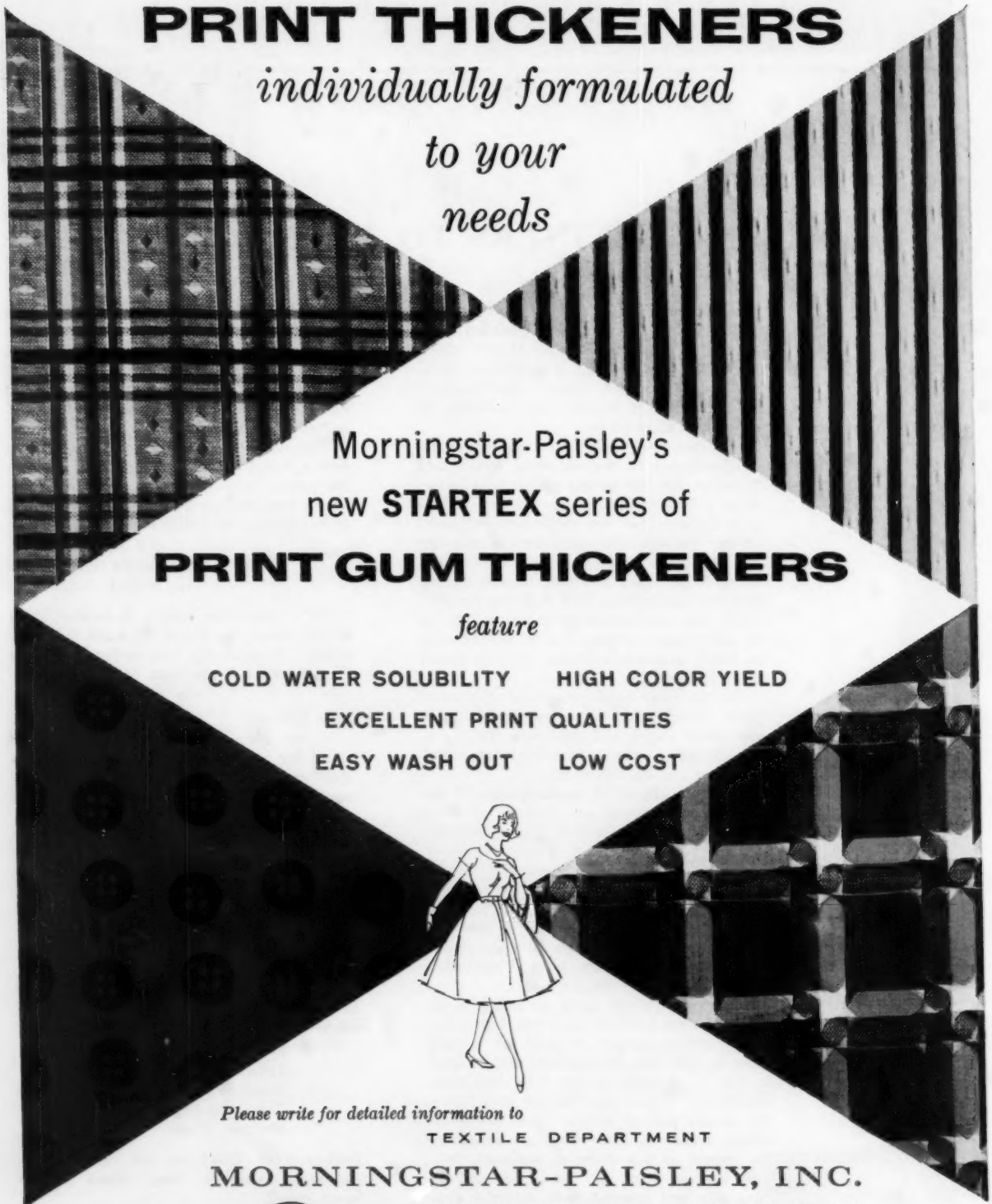

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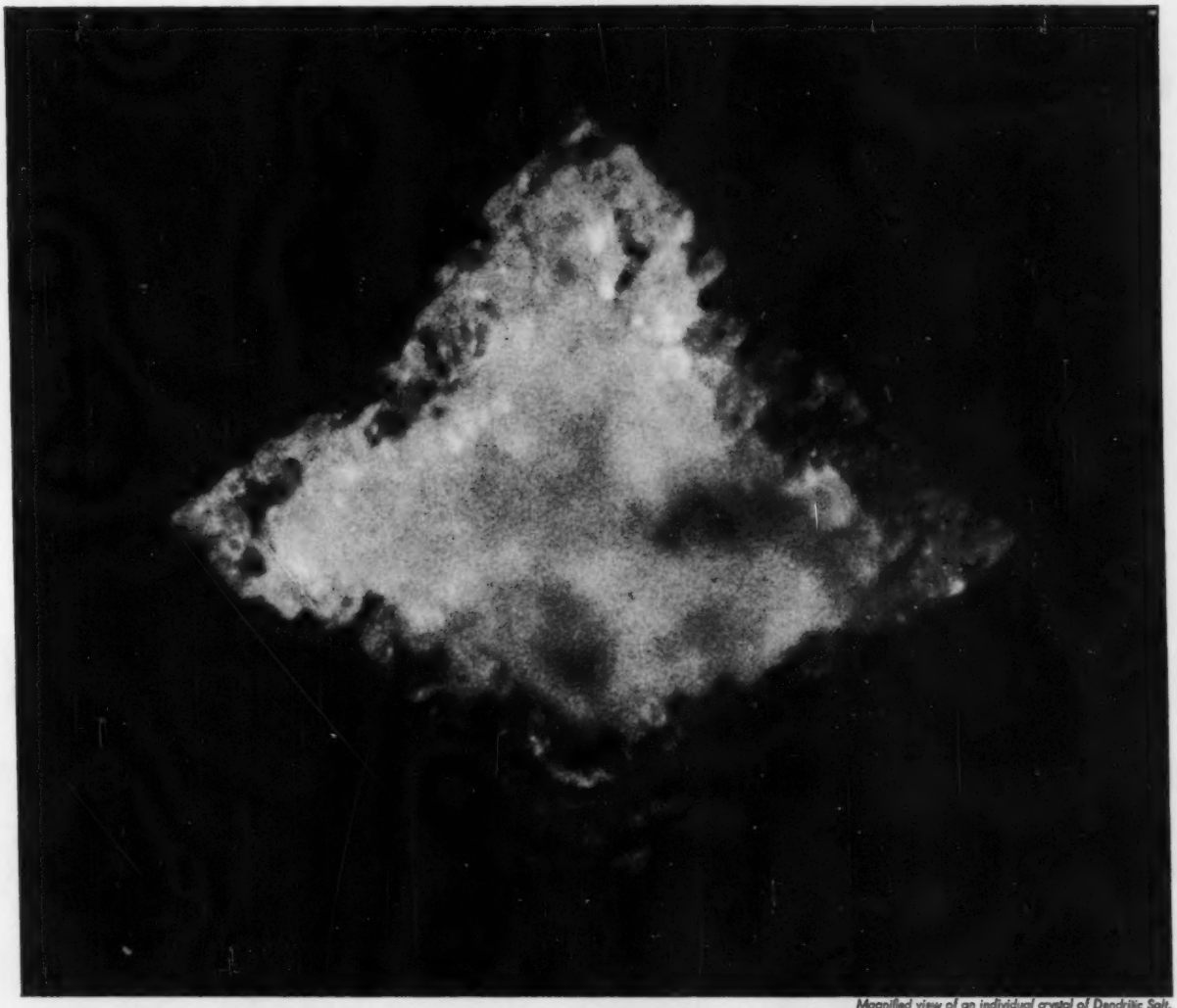

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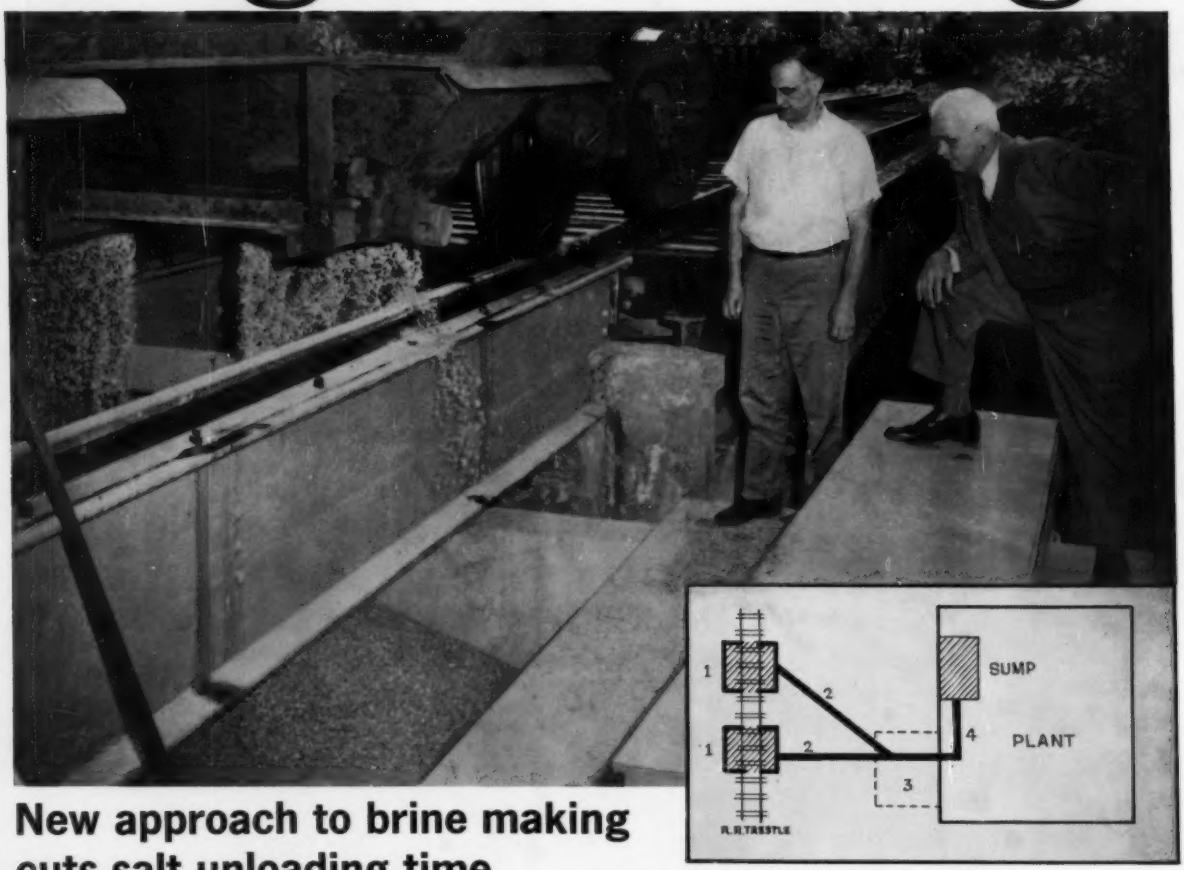

Pipes (2) deliver brine from new 55-ton Lixators (1) to existing pipe line (4) that served old Lixator (3). New construction made maximum use of existing installation—did not affect railroad trestle or plant interior.

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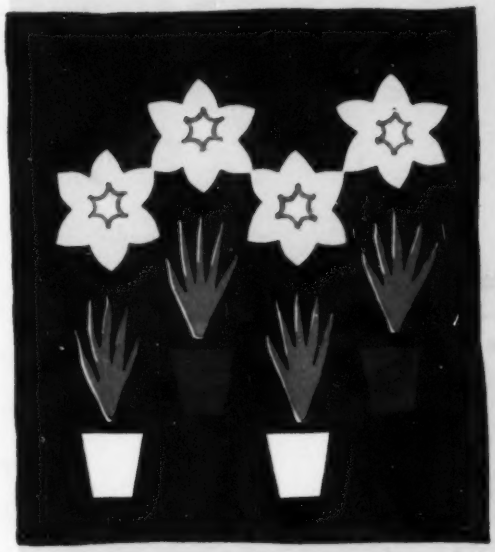

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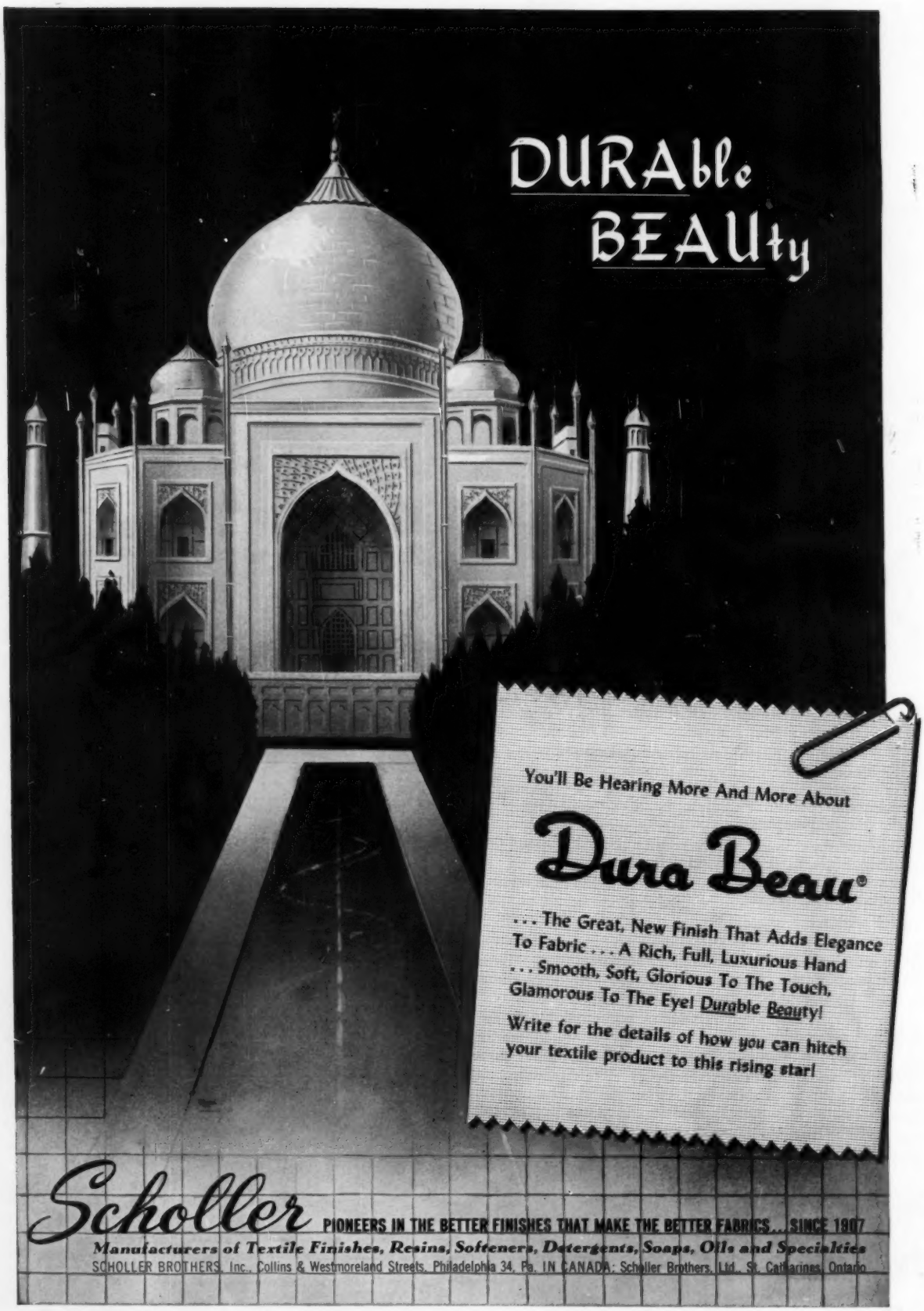
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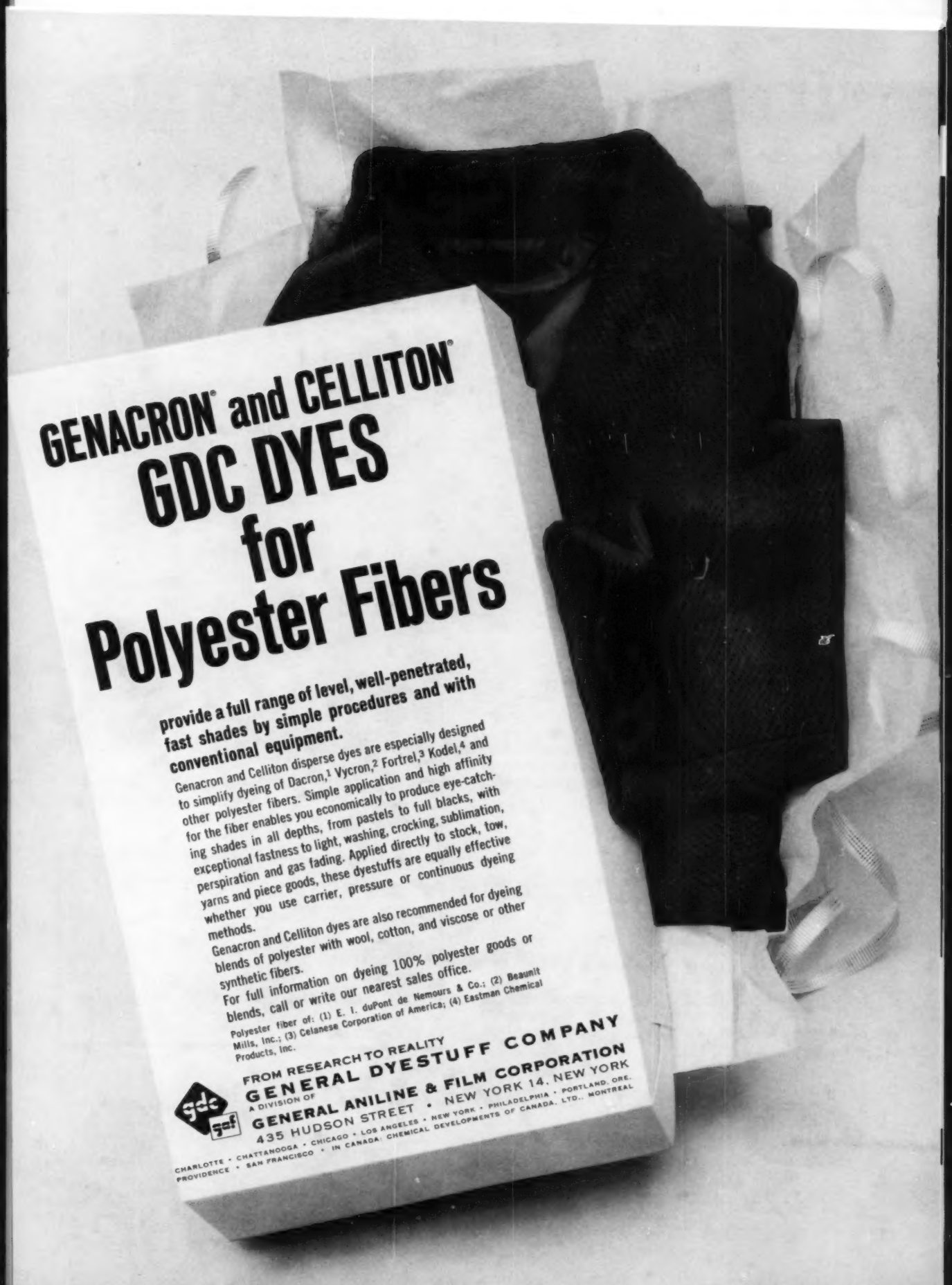
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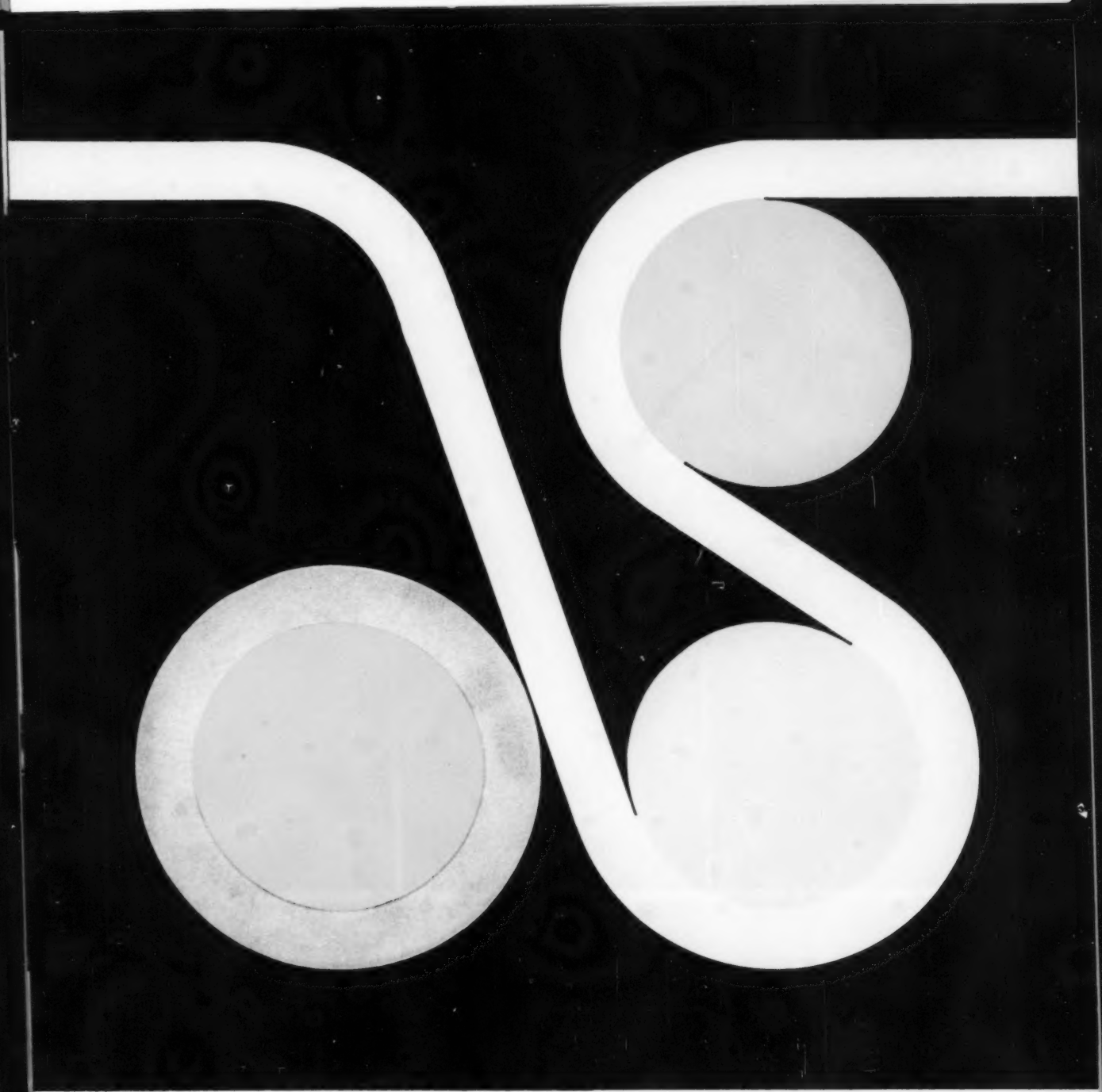

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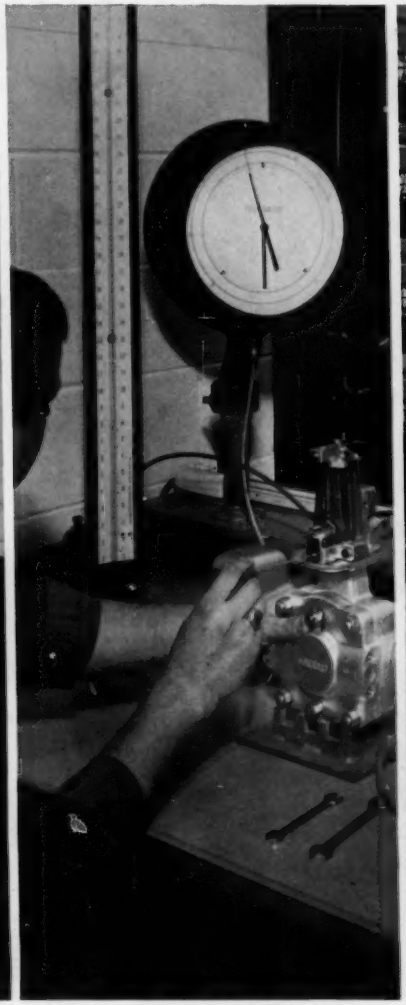

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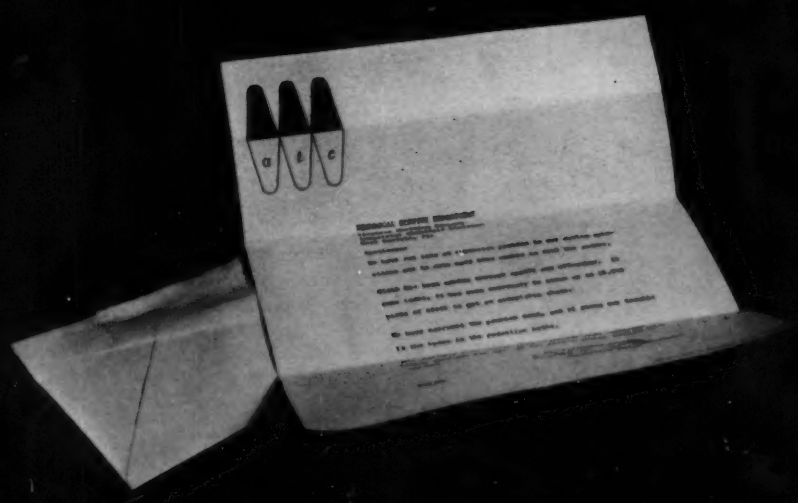

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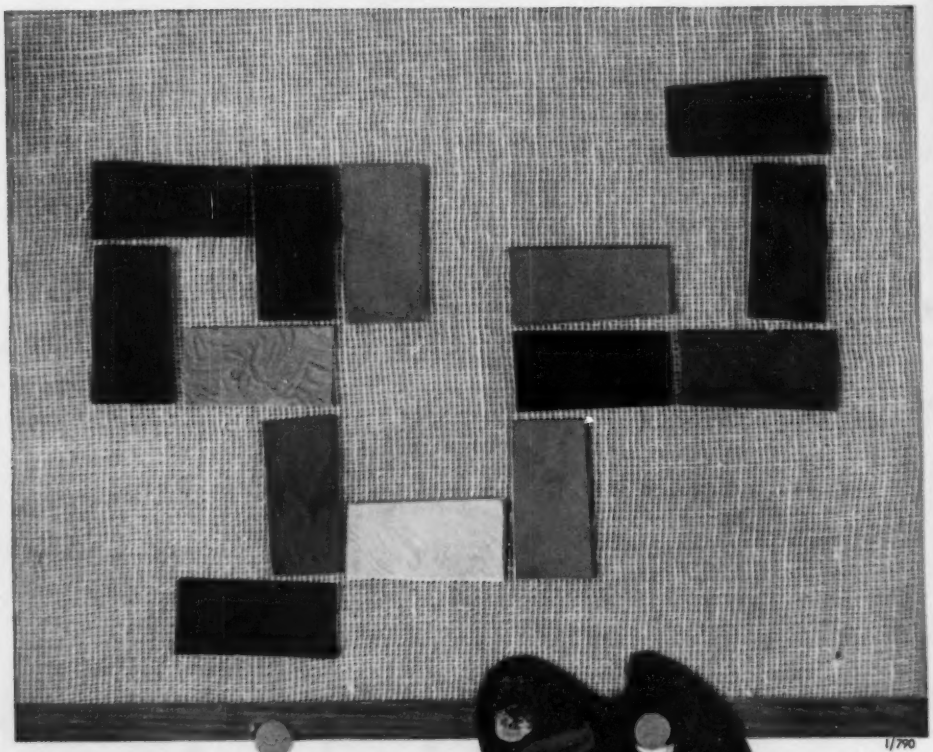

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USE OF MODERN HOME LAUNDRY EQUIPMENT

I. Wrinkling Effects on Swatches of Present-Day Fabrics

R KATHERINE TAUBE, ENID S ROSS and NADA D POOLE

Clothing and Housing Research Division
Agricultural Research Service
U S Department of Agriculture
Washington, D C

This study of laundering procedures investigated wrinkling effects on 27- X 30-inch swatches of 27 different fabrics of Arnel, cotton, Dacron, nylon and Orlon fibers and some blends of these, through nine launderings. Subjective judgments of the need for ironing of fabrics were used throughout to evaluate effects of such variables as type of washer, weight of load, wash and rinse-water temperatures, speed of agitation, length of wash, speed of spinning, and various aspects of drying methods. For evaluation of effects of some variables, wrinklemeter and crease-recovery measurements were also used, and were themselves evaluated as measurement tools.

A second part of the study, which will be reported separately, applied those laundering procedures which caused least wrinkling in swatches to naturally soiled blouses made of some of the same fabrics through 17 "wash-wear" periods.

INTRODUCTION

HAND washing and drip drying of "easy-care" fabrics, although often recommended to minimize ironing, may actually add to the time and energy expenditure of the homemaker. The special kind and amount of space required for dripping, and the necessity for handling "drip-dry" articles differently from the rest of the family laundry may more than offset the advantages claimed for the fabric. Therefore, equipment manufacturers and others concerned are seeking to bring to the public new features of equipment which offer better possibilities of caring for the entire family laundry more efficiently and conveniently. The research reported here investigated methods of using modern home-laundry equipment as they affected the wrinkling of unsoiled swatches of present-day fabrics. Removal of soil from naturally soiled blouses made of some of these fabrics will be reported as Part II.

Procedures for panel evaluation of the need for ironing the laundered swatches were developed as part of this research, since standard judging methods* were not available. The Hunter Laboratories designed a wrinklemeter, a pioneering instrument (*1*) which provided an objective means of evaluating degree of wrinkling. Crease-recovery angles of selected fabrics were also measured.

Thus, in addition to evaluating the use of household equipment in maintaining smoothness of fabrics, this research shows how wrinklemeter measurements agreed with judging panel evaluations, and the relationship of crease-recovery measurements to panel scores.

*While the work in this laboratory was in progress, the Committee on Wash and Wear of the AATCC agreed on Tentative Test Method 88-1958, which was published in *American Dyestuff Reporter* of August 25, 1958.

EXPERIMENTAL

HOUSEHOLD LAUNDRY EQUIPMENT USED——Two washers were selected from each of three types—agitator automatic, agitator wringer, and tumbler automatic, Table I. The agitator automatics were chosen from a group which offered two agitation speeds and two spinning speeds.

One gas and one electric tumbler dryer were chosen from each of three manufacturers. Each dryer had a range of temperature settings and a setting for tumbling without heat, Table II. Rack drying indoors was also a part of the experiment.

FABRICS STUDIED——Fabrics selected from the white lingerie and blouse materials available as yard goods at the beginning of the study (1956) were purchased from manufacturers on the basis of fiber content or finish which would be expected to impart "minimum-care" properties to the fabrics, Table III. Since it was desirable to include one swatch of each fabric in each experimental washer load, the sampling of the market was limited to 25 fabrics. Constructions represented were plain, satin, crepe weaves and tricot knit; the fibers were Arnel, cotton, Dacron, nylon, and Orlon. Also included were three cottons from Southern Utilization Research and Development Division of the Agricultural Research Service. One was an untreated print cloth; the other two were this same fabric finished with two experimental resin treatments (1957).

The fabrics were cut into swatches approximately 27 inches warpwise by 30 inches fillingwise and hemmed if necessary to prevent ravelling.

WASHING AND DRYING PROCEDURES——Wrinkling effects of the following variables were

TABLE I
Washers used in the study

Designation	Type	Tub capacity Gal	Activation speed Normal PM	Activation speed Slow PM	Spinning speed Normal RPM	Spinning speed Slow RPM	Rinse cycle
A	Agitator automatic	19.7	72	40	597	339	One deep agitated.
B	Agitator automatic	18.6	72	46	522	346	Sprays; one deep agitated; sprays.
C	Agitator wringer	19.9	54	—	—	—	Manual.
D	Agitator wringer	19.8	57	—	—	—	Manual.
E	Tumbler automatic	7.0	62	—	525	—	Flush during pumpout after wash; two deep tumbled.
F	Tumbler automatic	8.4	50	—	500	—	Spray; two deep tumbled

TABLE II
Automatic dryers used in the study

Dryer manufacturer*	Heat source	Manufacturer's rating	Temperature control markings	Vent location**	Drum Diameter Inches	Drum Depth Inches	Drum Finish	Drum Design	Drum Speed RPM	Manufacturer's rating of clothes capacity Pounds (dry)
A	Electric	4,800 Watts	Off (tumbles without heat), lo, med, hi	Top, center of rear	16	18	Anodized aluminum	Perforated	50	9
	Gas	18,000 Btu							36	9
B	Electric	4,700 Watts	Fluff-dri (tumbles without heat), fine fabrics, knits, cotton-wool	Front, center of bottom	13	17.5	Anodized aluminum	Perforated	50	9
	Gas	18,000 Btu							50	9
C	Electric	6,000 Watts	Air (tumbles without heat), low, warm, med, hot	Top, right of rear	13	15	Enamelled steel	Solid	48	10
	Gas	37,000 Btu							48	10

*The two dryers from each manufacturer were essentially alike except for heat source.
**When a thermocouple was used, it was placed in the vent to measure temperature.

TABLE III
Fabrics used in the study

Fabric designation	Fiber Warp	Fiber Filling	Construction	Yarn count Warp	Yarn count Filling	Crease-recovery angle Warp plus filling Degrees	Weight per square yard Ounces	Finish (when known)
A	Nylon	Dacron-rayon	Crepe	214	94	277	2.3	
B	Nylon	Dacron-cotton	Plain	145	105	288	2.2	
C	Arnel	Arnel	Satin	222	76	240	3.5	
D	Dacron	Dacron	Tricot	48	51	—	2.8	
E	Arnel	Arnel	Crepe	141	73	271	3.1	
F	Cotton	Cotton	Plain	89	74	179	3.7	
G[1]	Cotton	Cotton	Plain	86	75	275	3.7	Dimethylol cyclic ethylene urea with polyethylene thermoplast
H	Nylon	Nylon	Satin	279	130	262	2.9	
I	Dacron-cotton	Dacron-cotton	Plain	103	92	289	2.7	
J	Orlon	Orlon	Plain	84	71	294	2.2	
K	Nylon	Nylon	Tricot*	52	74	—	1.7	
L	Nylon	Nylon	Tricot**	50	58	—	3.1	
M	Arnel	Arnel	Tricot	40	43	—	3.0	
N	Nylon	Nylon	Satin	294	131	302	2.5	
O	Orlon	Nylon	Plain	206	101	279	2.3	
P	Cotton	Cotton	Plain	88	81	219	3.6	Epoxy resin
R	Dacron	Dacron	Crepe	113	104	323	2.2	
S	Dacron-cotton	Dacron-cotton	Plain	105	97	291	2.8	
T	Arnel	Arnel	Plain	186	62	236	3.0	
U	Nylon	Dacron-cotton	Plain	126	100	292	1.8	Urea-formaldehyde resin with additives
V	Cotton	Cotton	Plain	85	86	255	3.5	Melamine ethylene urea with acrylic latex and silicone
W	Cotton	Cotton	Satin	104	93	214	4.1	Aminoplast resin of dimethylol ethylene urea type with additives
X	Dacron	Dacron	Plain	102	66	305	2.2	
Y[1]	Cotton	Cotton	Plain	89	75	287	3.6	Dimethylol cyclic ethylene urea with acrylate thermoplast and silicone
Z[1]	Cotton	Cotton	Plain	88	77	145	3.3	Untreated

[1]Supplied by Southern Utilization Research and Development Division, Agricultural Research Service
*20 denier
**40 denier

studied: type of washer, weight of load, temperature of wash water, speed of agitation, length of wash, cooling wash water before the spin, speed of spinning, length of spin, temperature of rinse water, drying method, tumble-drying temperature, and tumbling time without heat after drying. A variety of washing procedures was used to cover a range of washing conditions which could be obtained in the home—from the small loads of delicate fabrics usually washed separately, to the rather indiscriminate mixing of all kinds of fabrics in larger loads.

The investigation was divided into eight experimental units, as outlined in Table IV. The laundering procedure for each treatment included a 0.025 percent solution (based on weight) of a built detergent containing an optical whitener. For the rinse in the agitator wringer washer the swatches were agitated one minute in the same amount of water used for washing; the automatic washer was allowed to fill and cycle automatically for the normal rinse period.

Hand washing and rinsing for experiment 2 were done in a laundry tub in 12 gallons of 100°F water. Samples were in the detergent solution a total of eight minutes. During this time each sample was individually rubbed between the hands, as if it were a garment. Samples were given two one-minute rinses. No wringing or squeezing was used. In machine washing for this experiment swatches were removed from the

TABLE IV
Experimental plan

Variable	Experiment 1	2	3	4	5	6	7	8
Washing method[1]								
Hand washing		x						
Agitator automatic	x	x	x	x	x	x	x	x
Agitator wringer	x							
Tumbler automatic	x							
Load								
Three pounds		x		x				
Five pounds	x		x	x	x	x	x	x
Seven pounds				x	x			
Washing temperature								
60°F			x					
100°F		x	x		x		x*	
140°F	x		x	x		x		x
Washing time								
Four minutes				x				
Eight minutes	x	x	x	x	x	x	x	x
Rinsing temperature								
60°F			x				x	
100°F	x	x	x	x	x	x		x
Agitation speed								
Regular	x	x	x	x	x	x	x	x
Slow					x			
Spinning speed								
Regular	x	**	x	x	x	x	x	x
Slow					x			
Spinning time								
Regular	x	**	x	x	x	x	x	x
One-third			x					
Drying method								
Drip		x						
Rack	x		x	x	x		x	
Electric tumbler	x	x		x				
Gas tumbler	x	x				x		x
Drying temperature								
130°F + −10°	x							x
150°F + −10°						x		x
180°F + −10°	x	x		x				x
Tumbling without heat after drying								
0 minutes						x		
10 minutes	x	x		x		x		x
20 minutes						x		
Judged after laundering number								
1	x	x	x	x	x	x	x	x
3		x				x		x
5	x	x	x	x	x	x	x	x
7		x				x		x
9	x	x	x	x	x	x	x	x
Number of loads	30	8	24	24	16	6	4	6

[1]Two people did the hand washing, using the same method. Two washers were used in each machine method.
*In two of the loads the wash water was cooled to approximately 65° by introducing cold water before spinning.
**Spinning was omitted in this experiment.

washer before the water extraction process after both washing and rinsing. From both washing processes swatches for tumble drying were placed on terry towels to absorb excess water so they would not drip in the dryers.

Drying in the automatic dryer was always begun with the dryer at room temperature; dryers were used in rotation within each heat source. The position at which dryer controls were set to give the desired drying temperature was established by preliminary tests using maximum-temperature-indicating Thermotubes pinned to fabric samples in a load. Temperatures of test-load samples were checked periodically in a similar manner.

One swatch of each fabric was randomly assigned to a load for treatment. The basic load weighed approximately three pounds. For study of the effect of heavier loads, plain white cotton flour-sack pieces about the same size as the fabric swatches were added to provide total weight required.

EVALUATION OF LAUNDERED SWATCHES——The degree of wrinkling was measured by one or more methods after one, five, and nine launderings and in some cases also after three and seven.

Panel judging. A panel of six employees evaluated each set of samples. Three at a time, judges were seated with their backs to a west window. They viewed single samples held against a background of beige cotton draped over a horizontal bar 41 inches from the floor, about four feet in front of their chairs. The top of the sample was held approximately at the height of the bar. All judging sessions took place in the morning. In general, daylight of 25 ± 5 foot-candles intensity illuminated the samples. Continuous cloudy skies sometimes forced judging with lower intensity, but it was never done with less than 15 foot-candles. On a very bright day a Venetian blind was adjusted to admit the proper amount of natural light.

The samples of a load were randomized for presentation to the judges, but were kept together within the load; loads were also randomized in order of judging at each session. The form for the score sheet follows:

"If this were a blouse which I had laundered and planned to wear, on the *basis of wrinkling only*, I would consider it—

5. Excellent. Needs no pressing
4. Good. Wearable but "touching up" would improve
3. Fair. Wearable but light over-all pressing would improve
2. Poor. Not wearable. Wrinkled enough to require complete ironing
1. Very poor. Not wearable. Badly wrinkled."

Wrinklemeter measurements. The optical wrinklemeter has been described by the designers (*1*) in a previous issue of this journal. Comparisons of wrinklemeter readings made according to the techniques used at the time of the study were limited to specimens of a single fabric rather than interfabric comparisons. For a few fabrics measurements were off scale. Of other fabrics only swatches from some treatments could be measured. A few were not measured because judges' scores showed that the swatches needed ironing regardless of treatment.

A wrinklemeter measurement was made at random in each of four locations on a swatch. An area approximately 4 × 6 inches was measured with each reading; this represented a coverage of about ⅛ of the swatch area. The instrument was standardized with an untreated bias piece of the fabric being measured, and the wrinkled swatch was measured in the bias direction.

Crease recovery measurements. Crease recovery was determined acording to ASTM Designation D1295-53T (*2*). Three warp and three filling measurements were made of each selected swatch after nine launderings.

STATISTICAL TREATMENT——In the comparisons of effects of different laundering equipment or conditions, all statements of statistical significance refer to the five percent level of probability. Significance between means was determined by using methods developed by Duncan. Fabrics are usually omitted from the discussion if it was evident from appraisal of their scores that no differences were involved, as when all swatches of a fabric were scored similarly low so that complete ironing was required from all treatments, or if analysis of scores showed no significant differences in any treatment effects. This accounts for the absence of data from fabrics C, F, T, W, and Z. These fabrics proved to be poor tools for comparing laundering effects, since they were seldom given scores better than very poor.

RESULTS AND DISCUSSION

PANEL JUDGING——Tables V through IX give mean scores for fabrics in which there were significant differences in wrinkling due to one or more of the variables. In all tables where means are given, each mean is made up of values from all other variables in that experiment except those being compared. Figures

TABLE V

Scores for wrinkling: Effect of washer type, drying method, and drying temperature[1]

Fabric	Washer types[2]			Drying method		Drying temperature[2]		Times laundered[2]		
	Agitator automatic	Agitator wringer	Tumbler automatic	Rack[3]	Tumbler[4]	130°F	180°F	1	5	9
A	2.15a	2.53b	2.48b	1.64a	2.57b	2.45a	2.70b	2.53a	2.31a	2.33a
B	2.24a	2.37a	2.33a	1.88a	2.42b	2.28a	2.56b	2.36a	2.14a	2.44a
D	2.47a	2.25a	2.68a	1.98a	2.59b	2.61a	2.57a	2.61b	2.28a	2.52ab
G	2.07a	2.05a	2.11a	1.88a	2.13b	2.11a	2.15a	2.18a	2.03a	2.03a
I	1.69a	1.74a	1.78a	1.37a	1.83b	1.74a	1.72b	1.76a	1.76a	1.69a
K	2.45a	2.61a	2.59a	2.07a	2.67b	2.74a	2.61a	2.96c	2.04a	2.63b
L	2.93a	2.90a	3.12a	2.26a	3.17b	3.47b	2.86a	3.32c	2.64a	2.99b
N	1.72a	1.66a	1.60a	1.50a	1.70b	1.77a	1.63a	2.03b	1.40a	1.55a
O	1.37a	1.54a	1.56a	1.29a	1.54b	1.75b	1.33a	1.85b	1.33a	1.29a
P	1.62a	1.60a	1.60a	1.44a	1.65b	1.66a	1.64a	1.72b	1.60ab	1.50a
R	1.57a	1.87b	1.86b	1.63a	1.80a	1.74a	1.87a	1.89b	1.64a	1.78ab
S	2.06a	2.00a	2.02a	1.74a	2.10b	2.07a	2.14a	2.07a	1.97a	2.05a
U	2.36a	2.37a	2.32a	2.00a	2.44b	2.49a	2.39a	2.20a	2.36ab	2.49b
V	1.51a	1.53a	1.57a	1.64a	1.51a	1.50a	1.52a	1.68b	1.51a	1.42a
Y	1.88a	1.86a	1.78a	1.58a	1.91b	1.89a	1.92a	1.97b	1.81a	1.75a
Mean	2.01	2.06	2.09	1.73	2.14	2.15	2.12	2.21	1.92	2.03

Note: Data for a fabric marked with the same superscript within a variable were not significantly different at the five-percent level of probability.
[1]Six judges rated each fabric on a five-point scale from 5 (excellent, needs no pressing) to 1 (very poor, not wearable, badly wrinkled).
[2 3 4]Mean of 180, 108, 432, and 216 judgments respectively.

TABLE VI

Scores for wrinkling: Effect of hand and machine washing, drip and tumble drying[1]

Fabric	Washing method[2]		Drying method[2]		Times laundered[2]				
	Hand	Machine	Drip	Tumble	1	3	5	7	9
A	3.03a	2.64a	2.42a	3.24b	3.04a	2.75a	2.64a	2.60a	3.14a
D	3.25a	3.26a	3.26a	3.25a	3.45c	2.75a	3.48c	3.11b	3.49c
E	1.20a	1.22a	1.05a	1.37b	1.18a	1.21a	1.30a	1.12a	1.24a
G	2.42a	2.26a	2.50b	2.18a	2.42a	2.24a	2.29a	2.39a	2.36a
I	2.84a	2.55a	3.16b	2.23a	2.76a	2.32a	2.86a	2.59a	2.92a
J	1.39a	1.31a	1.53a	1.17a	1.59b	1.29a	1.38a	1.22a	1.28a
L	3.48a	3.30a	3.04a	3.74b	3.15ab	2.96a	3.42bc	3.59cd	3.82d
M	1.72a	1.94a	1.72a	1.95a	1.61a	1.59a	1.80ab	2.08b	2.09b
O	1.60a	1.48a	1.72b	1.36a	1.79b	1.39a	1.52a	1.59ab	1.44a
P	1.76a	1.78a	2.06b	1.48a	1.59a	1.69a	1.75a	1.80a	2.01b
R	2.72a	2.34a	3.00b	2.06a	3.34a	2.16a	2.59a	2.15a	2.41a
S	2.90a	2.63a	2.94a	2.60a	2.86b	2.50a	2.66ab	2.59ab	3.21c
U	2.79a	2.81a	2.90a	2.70a	2.34a	2.75b	2.85b	2.94b	3.12b
V	1.85a	1.73a	2.11b	1.47a	1.70a	1.82a	1.80a	1.72a	1.90a
X	3.11a	3.02a	3.62b	2.52a	3.82c	2.48a	2.95b	2.86ab	3.22b
Mean	2.40	2.28	2.47	2.22	2.44	2.13	2.35	2.29	2.51

Note: Data for a fabric marked with the same superscript within a variable were not significantly different at the five-percent level of probability.
[1]Six judges rated each fabric on a five-point scale from 5 (excellent, needs no pressing) to 1 (very poor, not wearable, badly wrinkled).
[2 3]Mean of 120 and 48 judgments respectively.

TABLE VII

Scores for wrinkling: Effect of washing temperature, rinsing temperature, and spinning time[1]

Fabric	Washing temperature[2]			Rinsing temperature[2]		Spinning time[2]		Washer[2]		Times laundered[2]		
	60°F	100°F	140°F	60°F	100°F	Normal	1/3	A	B	1	5	9
A	3.22c	2.88b	1.91a	2.78a	2.56a	2.58a	2.77a	2.67a	2.68a	2.81b	2.68ab	2.53a
B	4.05c	3.56b	2.35a	3.46a	3.18a	3.15a	3.49a	3.31a	3.33a	3.45a	3.38a	3.13a
D	4.19b	4.08b	2.57a	3.69a	3.54a	3.45a	3.78a	3.56a	3.66a	4.02a	3.54a	3.28a
G	2.69a	2.71a	2.48a	2.64a	2.60a	2.54a	2.70a	2.63a	2.62a	2.99c	2.64b	2.25a
I	3.98b	3.25b	1.69a	3.18a	2.77a	2.78a	3.17a	2.92a	3.02a	3.23b	2.87a	2.82a
J	3.07c	1.89b	1.11a	2.39a	1.66a	1.92a	2.13a	1.92a	2.12a	2.23b	1.95a	1.88a
K	3.81a	3.81a	3.09a	3.60a	3.54a	3.40a	3.74a	3.58a	3.57a	3.81b	3.69b	3.21a
L	4.13a	4.16a	3.57a	4.04a	3.87a	3.79a	4.11a	3.97a	3.93a	4.23b	4.03ab	3.60a
N	2.33a	2.10a	1.88a	2.13a	2.08a	2.03a	2.18a	2.11a	2.10a	2.28b	2.25b	1.78a
O	2.64c	2.24b	1.15a	2.19a	1.82a	1.88a	2.13b	1.99a	2.03a	2.08b	2.10b	1.85a
R	3.75c	2.90b	1.55a	2.96a	2.51a	2.57a	2.90b	2.50a	2.97b	3.07a	2.63a	2.50a
S	3.89b	3.62b	1.99a	3.29a	3.04a	3.07a	3.27a	3.17a	3.17a	3.46b	3.07a	2.98a
U	3.86b	3.70b	2.26a	3.34a	3.20a	3.08a	3.46b	3.14a	3.41b	3.28a	3.35a	3.20a
V	2.42b	2.35b	2.10a	2.38a	2.20a	2.20a	2.38a	2.26a	2.31a	2.44a	2.32a	2.10a
X	4.13c	3.56b	1.76a	3.37a	2.93a	2.99a	3.31b	2.99a	3.31b	3.28b	3.18ab	3.00a
Y	2.15a	2.22a	2.07a	2.18a	2.11a	2.08a	2.21a	2.09a	2.20a	2.48b	2.13a	1.83a
Mean	3.39	3.06	2.10	2.98	2.73	2.72	2.98	2.80	2.90	3.07	2.86	2.62

Note: Data for a fabric marked with the same superscript within a variable were not significantly different at the five-percent level of probability.
[1]Six judges rated each fabric on a five-point scale from 5 (excellent, needs no pressing) to 1 (very poor, not wearable, badly wrinkled).
[2 3]Mean of 144 and 216 judgments respectively.

TABLE VIII

Scores for wrinkling: Effect of load weight, agitation time, and drying method[1]

Fabric	Load weight[2]			Agitation time[2]		Drying method[2]		Washer[2]		Times laundered[2]		
	3 lbs	5 lbs	7 lbs	8 min	4 min	Rack	Tumble	A	B	1	5	9
A	2.37a	2.32a	2.21a	2.28a	2.32a	1.66a	2.94b	2.29a	2.31a	2.27a	2.15a	2.48a
B	2.67a	2.35a	2.29a	2.43a	2.45a	1.93a	2.94b	2.37a	2.51a	2.27a	2.34a	2.71a
D	2.52a	2.38a	2.42a	2.38a	2.50a	1.99a	2.89b	2.35a	2.53a	2.52b	2.13a	2.66b
G	2.54b	2.27a	2.20a	2.29a	2.38a	2.14a	2.53b	2.38a	2.29a	2.30a	2.28a	2.44a
H	1.44a	1.25a	1.23a	1.29a	1.32a	1.18a	1.43b	1.32a	1.29a	1.53a	1.20a	1.39a
I	2.06a	1.79a	1.64a	1.79a	1.87a	1.40a	2.26b	1.75a	1.91b	1.72a	1.77a	2.00a
K	3.11b	2.49a	2.93b	2.77a	2.92a	2.64a	3.04b	2.82a	2.86a	2.64a	2.65a	3.25a
L	3.76c	2.98a	3.40b	3.12a	3.64b	2.98a	3.78b	3.36a	3.40a	3.25a	3.20a	3.68a
M	1.73a	1.60a	1.58a	1.67a	1.60a	1.46a	1.81b	1.52a	1.75b	1.50a	1.63a	1.78a
N	1.84a	1.81a	1.92a	1.81a	1.90a	1.58a	2.12b	1.91a	1.80a	1.87a	1.72a	1.98a
P	1.98a	1.75a	1.85a	1.85a	1.86a	1.74a	1.97b	1.87a	1.84a	1.71a	1.81a	2.05a
R	1.85b	1.74b	1.50a	1.67a	1.72a	1.31a	2.08b	1.64a	1.75a	1.62a	1.58a	1.89b
U	2.70b	2.46ab	2.18a	2.45a	2.45a	2.00a	2.90b	2.32a	2.57a	2.24a	2.31a	2.80b
V	2.00a	1.75a	1.80a	1.87a	1.83a	1.79a	1.91a	1.81a	1.89a	1.75a	1.80a	1.99b
X	2.18a	2.01a	1.70a	2.02a	1.92a	1.50a	2.43b	1.86a	2.07a	1.86a	1.91a	2.13a
Y	2.24a	2.03a	1.99a	2.02a	2.16a	1.83a	2.34b	2.08a	2.10a	2.10a	2.08a	2.08a
Mean	2.31	2.06	2.05	2.11	2.18	1.82	2.46	2.10	2.18	2.06	2.04	2.33

Note: Data for a fabric marked with the same superscript within a variable were not significantly different at the five-percent level of probability.
[1]Six judges rated each fabric on a five-point scale from 5 (excellent, needs no pressing) to 1 (very poor, not wearable, badly wrinkled)
[2 3]Mean of 144 and 216 judgments respectively.

TABLE IX

Scores for wrinkling: Effect of load weight, agitation speed, and spinning speed[1]

Fabric	Load weight[2]		Agitation speed[2]		Spinning speed[2]		Washer[2]		Times laundered[2]		
	5 lbs	7 lbs	Normal	Slow	Normal	Slow	A	B	1	5	9
A	2.24a	2.07a	2.21a	2.10a	2.23a	2.08a	2.19a	2.12a	2.28b	2.26b	1.92a
B	2.88b	2.39a	2.71a	2.56a	2.61a	2.66a	2.66a	2.61a	2.80b	2.82b	2.29a
D	3.47a	3.16a	3.34a	3.29a	3.31a	3.32a	3.25a	3.38a	3.46b	3.40b	3.09a
G	2.27b	2.01a	2.16a	2.11a	2.22a	2.06a	2.11a	2.17a	2.40c	2.14b	1.88a
I	2.44b	2.05a	2.31a	2.18a	2.30a	2.20a	2.11a	2.39a	2.46b	2.34b	1.95a
K	3.15b	2.67a	3.07a	2.75a	3.02a	2.80a	3.03a	2.79a	2.97a	3.11a	2.64a
L	3.43b	2.83a	3.27a	3.00a	3.14a	3.12a	3.12a	3.15a	3.33b	3.36b	2.70a
N	1.81b	1.57a	1.70a	1.68a	1.64a	1.74a	1.66a	1.72a	1.74a	1.79a	1.54a
O	1.78b	1.43a	1.54a	1.67a	1.62a	1.58a	1.59a	1.62a	1.77b	1.72b	1.32a
S	2.68b	2.27a	2.49a	2.46a	2.59a	2.36a	2.42a	2.52a	2.61b	2.56b	2.25a
U	2.94b	2.35a	2.77a	2.52a	2.70a	2.59a	2.70a	2.59a	2.66a	2.80a	2.47a
X	2.77b	2.30a	2.67a	2.40a	2.51a	2.55a	2.41a	2.65a	2.61a	2.56a	2.43a
Mean	2.66	2.26	2.52	2.39	2.49	2.42	2.44	2.48	2.59	2.57	2.21

Note: Data for a fabric marked with the same superscript within a variable were not significantly different at the five-percent level of probability.
[1]Six judges rated each fabric on a five-point scale from 5 (excellent, needs no pressing) to 1 (very poor, not wearable, badly wrinkled).
[2,3]Mean of 144 and 96 judgments respectively.

1 through 7 show interactions of two or more of the variables.

Effect of washer type, drying method, and drying temperature (Experiment 1, Table IV). Mean scores of 15 fabrics (Table V) indicated little difference in wrinkling attributable to type of washer except in fabrics A and R. In these two the agitator-automatic type left swatches significantly more wrinkled than did the other two types. Fabrics tumble dried were less wrinkled than those rack dried. Three fabrics were less wrinkled after drying at 180° than at 130°F and two were more wrinkled while the other 10 showed about the same degree of wrinkling from both drying temperatures, thus indicating that neither temperature could be considered superior for drying all of the fabrics.

Effect of hand and machine washing, drip and tumble drying (Experiment 2, Table IV). Mean scores of 15 fabrics (Table VI) indicated that hand-washing and machine-washing methods as used here did not differ significantly in wrinkling effect. Seven fabrics received better scores when drip dried, three when tumble dried, and five were similarly scored from the two methods.

Effect of washing temperature, rinsing temperature, and spinning time (Experiment 3, Table IV). Mean scores for the 16 fabrics (Table VII) show that, in general, as the temperatures of washing increased, wrinkling increased, and that differences between swatches washed at 100° and 140°F were usually greater than between those washed at 60° and 100°F. In six fabrics all three temperatures gave significantly different results; in five additional fabrics the swatches washed at 140°F were significantly more wrinkled than those washed at 60° or 100°F. For the two experimental cottons (G and Y) and three nylons (K, L, and N) the washing temperatures made no significant difference in wrinkling results.

In none of the 16 fabrics were the 60° and 100°F rinse temperatures significantly different in wrinkling effect.

Shortening the spinning time from normal to 1/3 of normal resulted in significantly less wrinkling in four of the fabrics, O, R, U, and X.

Effect of load weight, washing time, and drying method (Experiment 4, Table IV). For most of the 16 fabrics, scores given in Table VIII show that wrinkling was not significantly different whether swatches were washed in three-, five-, or seven-pound loads, and whether they were agitated four or eight minutes.

In all but one fabric, a resin-treated cotton (V), the tumble-dried swatches received higher scores than those rack dried.

Effect of load weight, agitation speed, and spinning speed (Experiment 5, Table IV). Mean scores of 12 fabrics from this experiment are given in Table IX. In this series, in which only rack drying was used, swatches washed in five-pound loads were scored better than those in seven-pound loads, except fabrics A and D. Normal and slow agitation were not significantly different in wrinkling effects on any of the fabrics; neither were normal and slow spinning.

Effect of time of tumbling without heat after drying (Experiment 6, Table IV). Mean scores are given in Table X for 18 of the fabrics. Results indicated that the length of tumbling time without heat after drying was completed did not significantly affect wrinkling except in fabric A, in which swatches tumbled 20 minutes without heat received the best scores.

Effect of cooling the wash water before spinning (Experiment 7, Table IV). Before the water was extracted from swatches at the end of the wash period, the wash water in one of the loads in each washer was cooled to approximately 65°F by introducing cold water into the tub.

Mean scores are given in Table XI for 17 of the fabrics from this experiment. No significant difference due to temperature was observed in the average wrinkling effects on any of the fabrics. Figure 1 shows that for several of the fabrics the relationship between scores for the two temperatures was not the same after one, five, and nine launderings.

Effect of three tumble-drying temperatures (Experiment 8, Table IV). Mean scores given in Table XII for 17 of the fabrics show no significant difference in the wrinkling effects of the three drying temperatures.

Trends in results shown by judges' scores. Although a relatively small number of variables investigated in this study resulted in significant differences in the scores for wrinkling of fabrics, certain factors in equipment and laundering conditions caused trends which should not be overlooked. Among the many fabrics in present use some might be more sensitive to the factors showing trends than were the fabrics included in this study.

Mean scores for the fabrics rinsed at 60° were consistently higher than for those rinsed at 100°F, although not significantly different, Table VII. The interactions plotted in Figure 2 partially explain why the rinse-temperature scores were not significantly different. Figure 2 shows that fabrics washed at 60°F generally were less wrinkled when rinsed at 60°F than at 100°F, and that in seven fabrics this difference was significant. At the washing temperature of 100°F, although fabrics from the 60°F rinse generally were also less wrinkled than those from the 100°F rinse, differences were smaller, and in only two fabrics was the difference significant. When fabrics were washed at 140°F, the rinse temperatures were never significantly different in wrinkling effect. And a few fabrics rinsed at 100°F were slightly less wrinkled than when rinsed at 60°F.

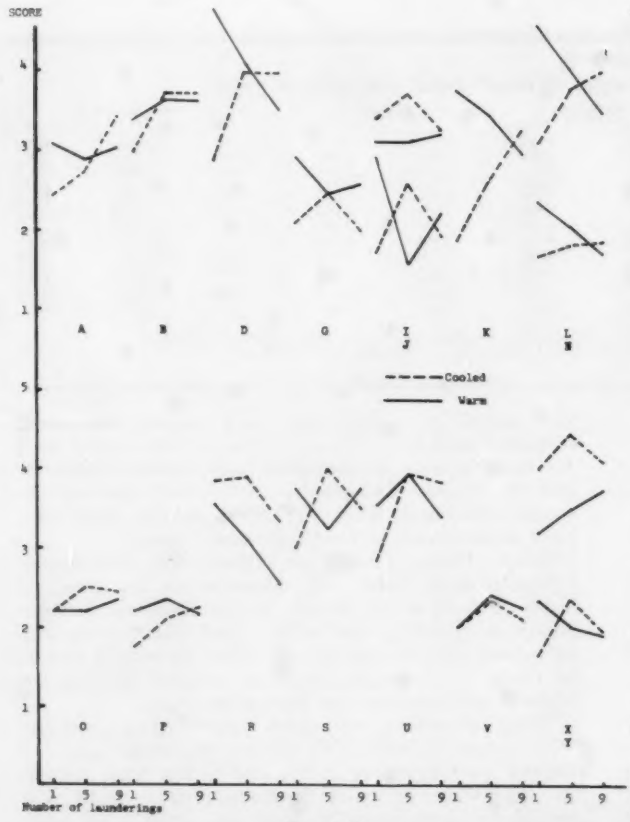

Figure 1

Scores for fabrics after one, five, and nine launderings in warm water, and in warm water cooled after extraction; mean of two washers.

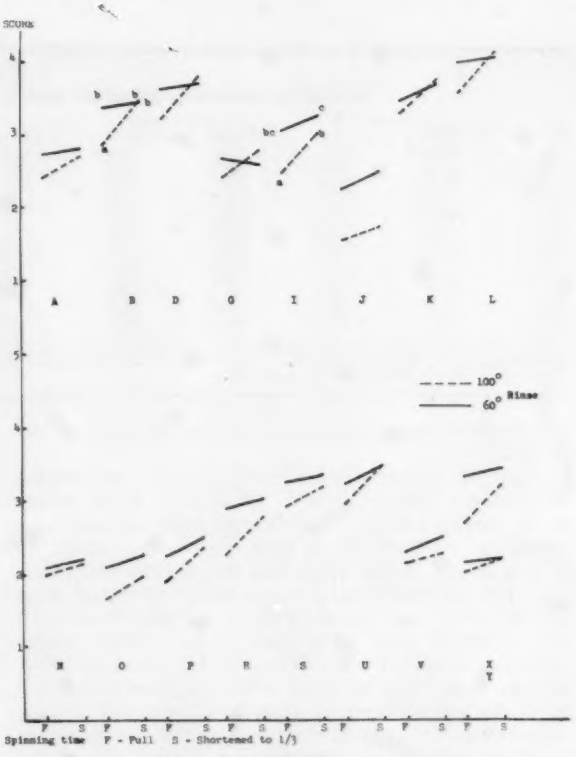

Figure 3

Scores for fabrics rinsed at 60° and 100°F, with water extracted for normal and 1/3 length of time; mean of three washing temperatures, two washers, and three judging periods. Within a fabric different letters denote significant differences at the 5% level of probability. In the fabrics not marked with letters there was no significant difference between the four scores.

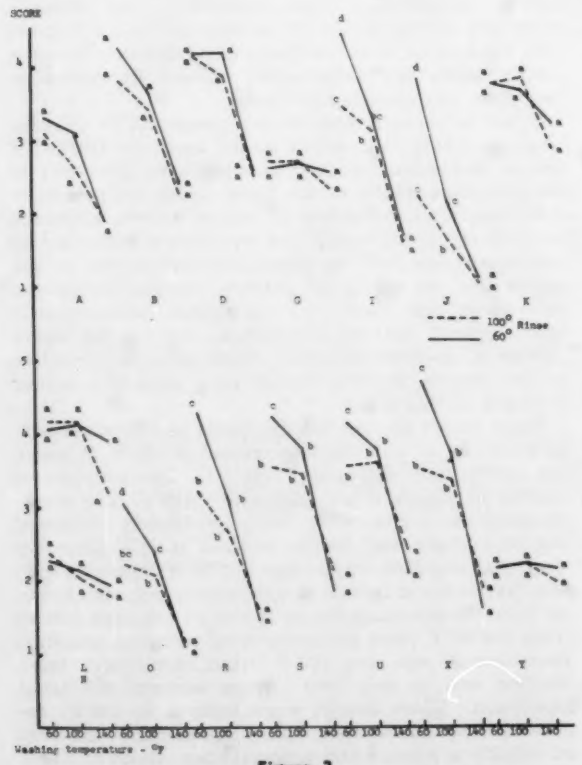

Figure 2

Scores for fabrics rinsed at 60° and 100°F, washed at 60°, 100°, and 140°F; mean of two spinning times, two washers, and three judging periods. Within a fabric different letters denote significant differences at the 5% level of probability.

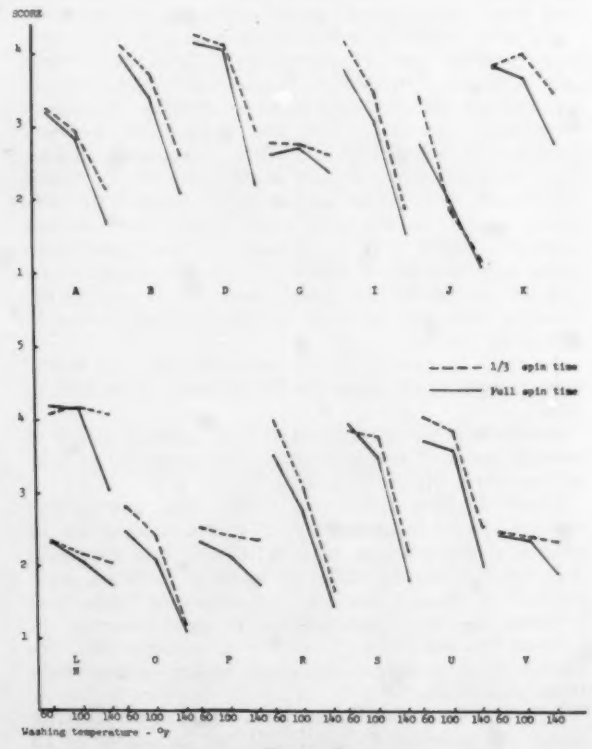

Figure 4

Scores for fabrics from which water was extracted for normal and 1/3 length of time after being washed at 60°, 100°, and 140°F; mean of two rinsing temperatures, two washers, and three judging periods.

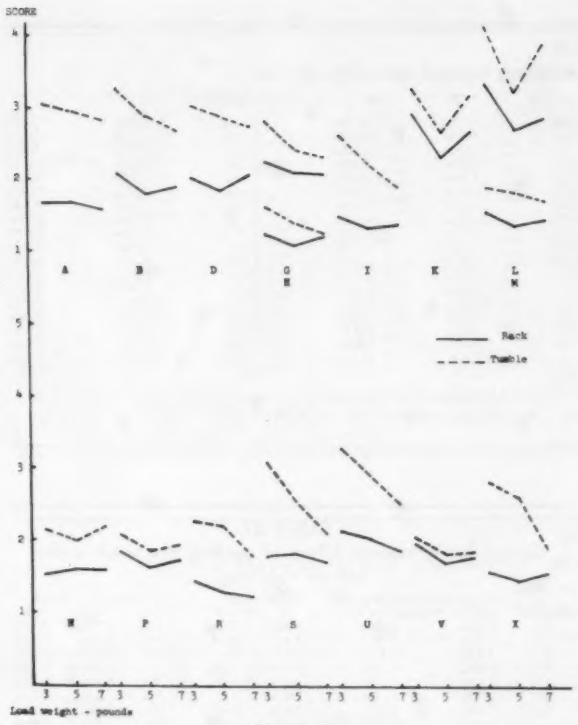

Figure 5
Scores for fabrics rack dried and tumble dried, after being washed in three-, five-, and seven-pound loads; mean of two agitation times, two washers and three judging periods.

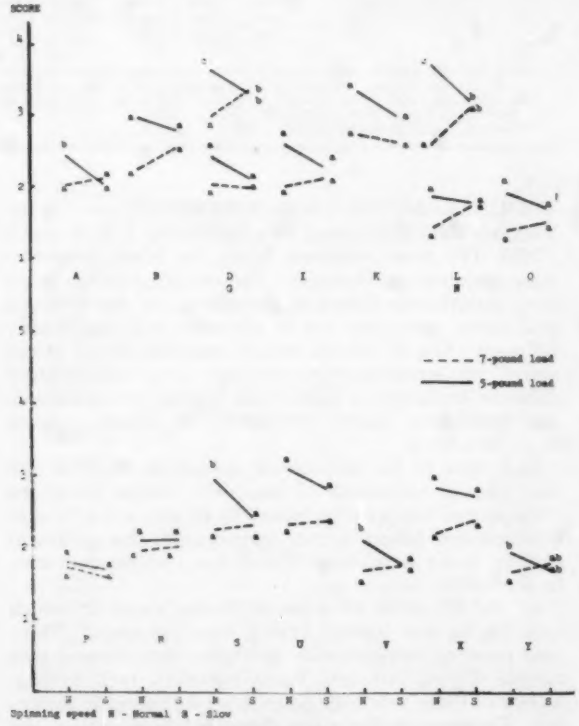

Figure 7
Scores for fabrics washed in five- and in seven-pound loads, from which water was extracted at slow and normal spinning speeds; mean of two agitation times, two washers, and three judging periods. Within a fabric different letters denote significant differences at the 5% level of probability.

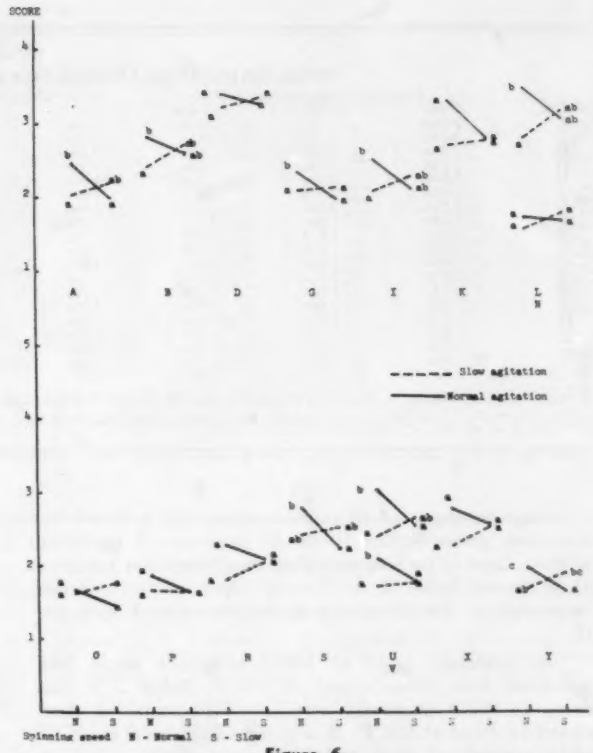

Figure 6
Scores for fabrics washed with normal and slow agitation, from which water was extracted at normal and at slow spinning speeds; mean of two load weights, two washers, and three judging periods. Within a fabric different letters denote significant differences at the 5% level of probability.

Mean scores were numerically larger for swatches from the 1/3 normal spin time for water extraction than for those from the normal spin time, Table VII. Although the difference was significant in only four fabrics, the trend was definite and consistent. Shortening the spin after the 100°F rinse tended to be somewhat more effective in minimizing wrinkles than after the 60°F rinse, Figure 3. Figure 4 shows the shortened spin somewhat more desirable after the 140°F wash than after the other two washing temperatures.

Load weights were not significantly different in wrinkling effect, yet the load weight scores showed a fairly consistent trend toward more wrinkling with larger loads, Table VIII. Figure 5 shows that this was more pronounced in tumble drying than in rack drying. In this same experiment there was a trend for swatches agitated four minutes to be less wrinkled than those agitated eight minutes.

When slow and regular agitation speeds were used, the trend was toward slightly better scores for those swatches agitated at normal speed, Table IX. In comparing spin speeds, there was no consistent trend for one speed to result in higher scores than the other, Table IX. Figure 6 shows the tendency toward lower scores with slow spin after normal agitation speed, but toward higher scores with slow spin after slow agitation. Figure 7, comparing spinning speeds used with the five- and seven-pound loads, shows the normal spin to be slightly more effective in minimizing wrinkling with the five-pound load, and the slow spin with the seven-pound load.

TABLE X

Scores for wrinkling: Effect of time of tumbling without heat after drying[1]

Fabric	Time of tumbling without heat[2]			Washer[3]		Times laundered[4]				
	0 min	10 min	20 min	A	B	1	3	5	7	9
A	3.36a	3.25a	3.59b	3.16a	3.64b	3.28a	3.70a	3.28a	3.08a	3.65a
B	3.23a	3.37a	3.51a	3.20a	3.54a	3.40a	3.37a	3.28a	3.27a	3.53a
D	3.39a	3.80a	3.54a	3.40a	3.75a	3.70a	3.52a	4.10a	3.27a	3.30a
G	2.71a	2.74a	2.75a	2.79a	2.67a	3.00a	2.48a	2.75a	2.67a	2.77a
H	1.48a	1.44a	1.56a	1.42a	1.57a	1.65a	1.67a	1.60a	1.32a	1.23a
I	2.48a	2.52a	2.62a	2.49a	2.59a	2.43a	2.62a	2.62a	2.42a	2.62a
K	3.57a	3.28a	3.81a	3.53a	3.58a	3.43a	3.70a	3.70a	3.55a	3.38a
L	4.24a	4.50a	4.41a	4.28a	4.49b	4.33a	4.33a	4.53a	4.42a	4.30a
M	2.02a	1.97a	1.92a	1.71a	2.23a	1.87a	2.23a	1.92a	1.95a	1.88a
N	2.61a	2.56a	2.54a	2.51a	2.63a	2.43a	2.77a	2.80a	2.38a	2.47a
O	1.19a	1.63a	1.75a	1.49a	1.55a	1.67a	1.55a	1.57a	1.33a	1.50a
P	2.03a	2.12a	1.98a	2.12a	1.97a	2.17a	2.00a	2.03a	1.97a	2.05a
R	2.34a	2.62a	2.40a	2.21a	2.69b	2.38a	2.40a	2.67a	2.38a	2.43a
S	2.77a	2.83a	3.02a	2.73a	3.01a	2.85a	2.93a	2.77a	2.92a	2.90a
U	3.27a	3.50a	3.49a	3.26a	3.58a	3.28a	3.45a	3.43a	3.13a	3.80a
V	1.82a	1.75a	1.71a	1.78a	1.74a	2.13a	1.68a	1.70a	1.58a	1.70a
X	2.20a	2.64a	2.56a	2.39a	2.54a	2.72a	2.48a	2.63a	2.30a	2.20a
Y	2.40a	2.34a	2.55a	2.46a	2.40a	2.60a	2.38a	2.43a	2.30a	2.43a
Mean	2.62	2.71	2.76	2.61	2.79	2.74	2.74	2.77	2.57	2.67

Note: Data for a fabric marked with the same superscript within a variable were not significantly different at the five-percent level of probability.
[1]Six judges rated each fabric on a five-point scale from 5 (excellent, needs no pressing) to 1 (very poor, not wearable, badly wrinkled).
[2] [3]Mean of 60, 90, and 36 judgments respectively.

Except in three of 18 fabrics, there was a trend for swatches given either 10 or 20 minutes of tumbling without heat to be less wrinkled than those not tumbled after drying, Table X. Half were improved and half not improved by the 20-minute period compared with the 10.

The swatches dried at 150°F generally were less wrinkled than those dried at 130°F, Table XII, but those at 180°F generally were not less wrinkled than swatches dried at 150°F. A few swatches dried at 180°F were considered less wrinkled than those dried at 130°F. The trend appeared, therefore, to favor slightly the 150°F drying temperature.

Summary of judging of wrinkling. Judges' scores for fabrics indicated significantly less wrinkling

from:	*than from:*
Washing at 60°F	Washing at 100°F
Washing at 100°F	Washing at 140°F
Washing in five-pound loads, rack dried	Washing in seven-pound loads, rack dried
Tumble drying after complete washer cycle	Rack drying after complete washer cycle
Drip drying after no water extraction	Tumble drying after no water extraction

Judges' scores for fabrics indicated trends toward less wrinkling

from:	*than from:*
A four-minute agitation period for washing	An eight-minute agitation period for washing
A regular agitation speed	A slow agitation speed
A shortened (1/3 full) spinning time	Full spinning time
A 60°F rinse	A 100°F rinse
Three-pound loads, rack and tumble dried	Five-pound loads, rack and tumble dried
Five-pound loads, rack and tumble dried	Seven-pound loads, rack and tumble dried
A tumble-drying temperature of approximately 150°F	A tumble-drying temperature of approximately 130°F or 180°F
Tumbling without heat for 10 or 20 minutes after drying was complete	No tumbling after drying was complete

Judges' scores for fabrics indicated no consistent differences in wrinkling between:

Agitator automatic, agitator wringer, and tumbler automatic washer types.

Hand laundering and machine laundering when each was followed by drip drying and tumble drying without previous extraction of water.

Cooling 100° wash water to 65°F before spinning, then rinsing in cold water, and proceeding from 100°F wash directly through spinning to rinsing in cold water.

Normal spinning speed and slow spinning speed.

Tumbling without heat for 10 minutes and for 20 minutes after drying.

Tumble drying at 130° and 180°F.

TABLE XI

Scores for wrinkling: Effect of cooling the wash water before spinning[1]

Fabric	Wash-water temperature[2]		Washer[2]		Times laundered[2]		
	100°F	Cooled to 65°F	A	B	1	5	9
A	3.02a	2.88a	2.82a	3.08a	2.78a	2.82a	3.25a
B	3.57a	3.50a	3.43a	3.63a	3.20a	3.70a	3.70a
D	4.13a	3.63a	3.95a	3.82a	3.85a	4.05a	3.75a
G	2.68a	2.20a	2.45a	2.43a	2.52a	2.50a	2.30a
I	3.18a	3.50a	3.30a	3.38a	3.30a	3.45a	3.28a
J	2.27a	2.10a	1.82a	2.55a	2.35a	2.10a	2.10a
K	3.43a	2.62a	3.17a	2.88a	2.85a	3.08a	3.15a
L	4.10a	3.68a	4.10a	3.68a	3.90a	3.98a	3.80a
N	2.08a	1.82a	1.97a	1.93a	2.05a	1.98a	1.82a
O	2.25a	2.38a	2.42a	2.22a	2.20a	2.35a	2.40a
P	2.23a	2.03a	2.08a	2.18a	1.98a	2.22a	2.20a
R	3.07a	3.70a	2.87a	3.90a	3.70a	3.50a	2.95a
S	3.58a	3.50a	3.28a	3.80a	3.38a	3.62a	3.62a
U	3.63a	3.55a	3.37a	3.82a	3.20a	3.95a	3.62a
V	2.22a	2.15a	2.22a	2.15a	2.00a	2.38a	2.18a
X	3.48a	4.18a	3.48a	4.18a	3.60a	3.98a	3.92a
Y	2.08a	1.98a	2.02a	2.05a	2.00a	2.18a	1.92a
Mean	3.00	2.91	2.87	3.04	2.87	3.05	2.94

Note: Data for a fabric marked with the same superscript within a variable were not significantly different at the five-percent level of probability.
[1]Six judges rated each fabric on a five-point scale from 5 (excellent, needs no pressing) to 1 (very poor, not wearable, badly wrinkled).
[2]Mean of 36 and 24 judgments respectively.

WRINKLEMETER MEASUREMENTS——Wrinklemeter data for fabrics in experiments 1, 3, 4, and 5 (Table IV) were analyzed fabric by fabric to determine treatment differences. The resulting means were then paired with means of the scores for the different treatments, whenever one or the other was significantly different. The 84 paired sets of means in which either scores or wrinklemeter readings were significantly different are given in Table XIII. Higher scores indicate less wrinkling; higher wrinklemeter values indicate more wrinkling.

Only nine of the sets agreed in both significance and the order of magnitude of treatment effects. These are underscored twice in the table. In 40 sets wrinklemeter readings and judges' scores agreed as to the treatment causing more wrinkling. These are underscored once in the table.

Of the 84 pairs, 27 were from the series in which rack drying and tumble drying were compared. Thirteen pairs of wrinklemeter and score data showed that tumble drying left less wrinkling than rack drying; in five of these sets both pairs were significantly different. Fourteen of the pairs disagreed in direction, the scores showing tumble-dried swatches less wrinkled than rack-dried swatches, and the wrinklemeter readings showing the opposite. In all but one of these 14 both scores and wrinklemeter readings were significantly different.

TABLE XII

Scores for wrinkling: Effect of three tumble-drying temperatures[1]

Fabric	Drying temperature[2] 130°F	150°F	180°F	Washer[3] A	B	Times laundered[4] 1	3	5	7	9
A	2.50a	3.25a	3.38a	2.99a	3.10a	3.15a	3.17a	2.73a	3.12a	3.05a
B	2.69a	3.37a	3.02a	2.79a	3.27a	3.15a	2.80a	2.97a	3.18a	3.03a
D	2.69a	3.80a	3.04a	3.09a	3.27a	3.37a	2.85a	3.45a	3.10a	3.12a
G	2.63a	2.74a	2.75a	2.74a	2.67a	3.13a	2.47a	2.60a	2.62a	2.72a
I	2.11a	2.52a	2.47a	2.31a	2.43a	2.58a	1.93a	2.43a	2.42a	2.47a
K	3.73a	3.28a	3.34a	3.37a	3.53a	3.53a	3.32a	3.43a	3.57a	3.40a
L	4.41a	4.50a	4.32a	4.47a	4.33b	4.48a	4.45a	4.48a	4.40a	4.23a
M	1.91a	1.97a	1.90a	1.73a	2.12a	1.78a	1.95a	2.05a	2.07a	1.78a
N	2.47a	2.56a	2.35a	2.34a	2.58b	2.60a	2.40a	2.68a	2.38a	2.23a
O	1.77a	1.63a	1.29a	1.58a	1.55a	1.80a	1.28a	1.68a	1.60a	1.45a
P	2.00a	2.12a	1.99a	2.07a	2.00a	2.27a	1.95a	2.05a	2.02a	1.90a
R	1.79a	2.62a	2.20a	2.03a	2.37a	2.48a	1.88a	2.07a	2.23a	2.35a
S	2.41a	2.83a	2.51a	2.41a	2.76a	2.82a	2.18a	2.55a	2.85a	2.52a
U	2.96a	3.50a	3.26a	3.19a	3.29a	3.37a	3.18a	3.23a	3.30a	3.12a
V	1.87	1.75	1.56	1.71	1.75	2.07	1.52	1.67	1.75	1.63
X	2.30a	2.64a	2.00a	2.09a	2.54a	2.68a	2.02a	2.45a	2.15a	2.27a
Y	2.32	2.34	2.23	2.24	2.35	2.65	2.18	2.33	2.25	2.07
Mean	2.50	2.79	2.57	2.54	2.70	2.82	2.44	2.64	2.65	2.55

Note: Data for a fabric marked with the same superscript within a variable were not significantly different at the five-percent level of probability. Those without superscripts were not analyzed.
[1]Six judges rated each fabric on a five-point scale from 5 (excellent, needs no pressing) to 1 (very poor, not wearable, badly wrinkled).
[2] [3] [4]Mean of 60, 90, and 36 judgments respectively.

TABLE XIII

Mean scores and wrinklemeter readings of fabrics with significant differences between treatments[1]

Fabric	Measure	Experiment 1 Washer types: Agitator automatic	Agitator wringer	Tumbler automatic	Experiment 3 Washer: A	B	Experiment 4 Washer: A	B	Experiment 5 Washer: A	B	Experiment 5 Load weight: 5 pounds	7 pounds	Experiment 5 Agitation speed: Normal	Slow	Experiment 4 Agitation time: 8 min	4 min
G	Score	2.07a	2.05a	2.11a			2.38a	2.29a			2.27b	2.01a				
	Reading	25.86b	24.55ab	22.70a			22.42a	24.05b			18.69b	16.02a				
I	Score						1.75a	1.91b			2.44b	2.05a				
	Reading						15.91a	15.99a			11.75a	11.24a				
K	Score										3.15b	2.67a				
	Reading										22.84a	23.19a				
L	Score										3.43b	2.83a			3.12a	3.64b
	Reading										12.14a	12.55a			8.75a	10.91a
N	Score						1.91a	1.80a	1.66a	1.72a	1.81b	1.57a				
	Reading						38.28b	37.19a	42.21a	43.26b	42.84a	42.63a				
O	Score								1.59a	1.62a	1.78b	1.43a				
	Reading								11.76a	13.15b	12.68a	12.23a				
P	Score	1.62a	1.60a	1.60a												
	Reading	13.42b	14.51b	11.90a												
R	Score	1.57a	1.87b	1.86b	2.50a	2.97b	1.64a	1.75a	1.90a	2.17a	2.10a	1.98a				
	Reading	6.40b	4.58a	3.57a	6.46a	5.16a	8.73b	6.64a	4.88b	3.10a	3.37a	4.61b				
S	Score	2.06a	2.00a	2.02a	3.17a	3.17a					2.68b	2.27a	2.49a	2.46a		
	Reading	14.69b	14.44b	12.58a	8.12a	9.30b					6.78a	5.34a	7.20b	4.92a		
U	Score	2.36a	2.37a	2.32a	3.14a	3.41b					2.94b	2.35a				
	Reading	17.37b	16.73b	14.40a	10.70a	11.92a					10.45a	9.12a				
V	Score								1.78a	1.88a						
	Reading								48.79b	47.28a						
X	Score				2.99a	3.31b	1.86a	2.07a	2.41a	2.65a	2.77b	2.30a				
	Reading				11.68a	12.02a	13.52b	12.08a	10.30b	8.29a	9.55a	9.04a				

Fabric	Measure	Experiment 3 Washing temperature: 60°F	100°F	140°F	Experiment 3 Spinning time: Normal	1/3	Experiment 1 Drying method: Rack	Tumble	Experiment 4 Drying method: Rack	Tumble	Experiment 1 Drying temperature: 130°F	180°F	Experiment 4 Load weight: 3 pounds	5 pounds	7 pounds
B	Score						1.88a	2.42b	1.93a	2.94b	2.28a	2.56b			
	Reading						2.83a	12.06b	3.58a	8.18b	12.30a	11.82a			
D	Score	4.19b	4.08b	2.57a	3.45a	3.78a	1.98a	2.59b	1.99a	2.89b					
	Reading	12.77a	12.04a	13.98a	14.45b	11.41a	14.77a	14.27a	14.88a	13.21a					
G	Score						1.88a	2.13b	2.14a	2.53b	2.11a	2.15a	2.54b	2.27a	2.20a
	Reading						20.84a	25.25b	20.61a	25.87b	26.39b	24.11a	22.08a	23.78a	23.85a
H	Score								1.18a	1.43b					
	Reading								32.11b	29.67a					
I	Score	3.98b	3.25b	1.69a			1.37a	1.83b	1.40a	2.26b	1.74a	1.92b			
	Reading	12.50a	13.32a	16.81a			12.04a	15.94b	14.88a	17.02b	15.82a	16.07a			
K	Score						2.07a	2.67b	2.64a	3.04b			3.11b	2.49a	2.93b
	Reading						20.19a	18.87a	21.73b	20.30a			21.28a	21.25a	20.53a
L	Score						2.26a	3.17b	2.98a	3.78b	3.47b	2.86a	3.76c	2.98a	3.40b
	Reading						9.76a	8.62a	10.37a	9.29a	9.43a	7.81a	10.07a	8.64a	10.78a
N	Score						1.50a	1.70b	1.58a	2.12b					
	Reading						39.85a	36.96a	38.48b	36.99a					
O	Score	2.64c	2.24b	1.15a	1.88a	2.13b	1.29a	1.54b			1.75b	1.33a			
	Reading	13.01a	13.17a	13.22a	12.98a	13.29a	9.82a	8.59a			8.55a	8.83a			
P	Score						1.44a	1.65b	1.74a	1.97b					
	Reading						8.86a	14.38b	9.99a	14.44b					
R	Score	3.75c	2.90b	1.55a	2.57a	2.90b			1.31a	2.08b			1.85b	1.74b	1.50a
	Reading	3.13a	4.38a	9.92b	5.67a	5.95a			9.14b	6.23a			6.36a	7.23a	9.46b
S	Score	3.89b	3.62b	1.99a			1.74a	2.10b			2.07a	2.14a			
	Reading	7.81a	7.80a	10.52a			7.66a	15.46b			14.62a	16.31b			
U	Score	3.86b	3.70b	2.26a	3.08a	3.46b	2.00a	2.44b	2.00a	2.90b	2.49a	2.39a	2.70b	2.46ab	2.18a
	Reading	9.05a	10.48a	14.41b	11.32a	11.30a	13.02a	16.95b	12.28a	16.12b	18.12b	15.79a	13.34a	14.76a	14.50a
V	Score	2.42b	2.35b	2.10a			1.64a	1.51a	1.79a	1.91a			2.00a	1.75a	1.80a
	Reading	48.74a	48.65a	48.70a			47.43a	51.72b	47.53a	50.73b			48.02a	49.59b	49.78b
X	Score	4.13c	3.56b	1.76a	2.99a	3.31b			1.50a	2.43b					
	Reading	7.98a	11.65b	15.91c	11.07a	12.63b			14.07b	11.54a					
Y	Score						1.58a	1.91b	1.83a	2.34b					
	Reading						9.49a	18.57b	9.23a	17.52b					

[1]Underscored groups indicate agreement between scores and wrinklemeter readings; double underscore indicates agreement in both measurements and significance.
Note: Data for a fabric marked with the same superscript within a variable, within a measurement, were not significantly different at the five-percent level of probability.

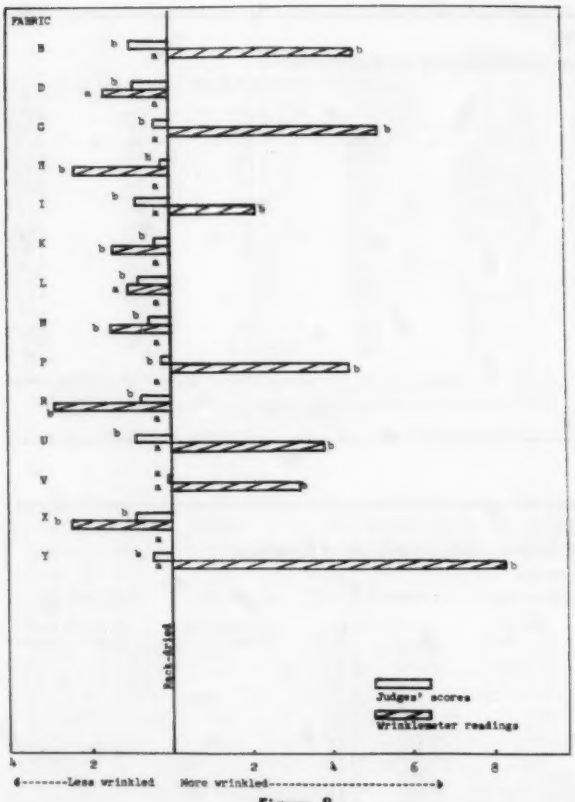

Figure 8

Differences in scores and wrinklemeter readings of tumble-dried swatches compared with rack-dried; mean of readings and of scores at three measurement periods. Within a fabric different letters denote a significant difference between rack and tumbler effects at the 5% level of probability.

Figure 8 shows the extent of the differences between data for the tumble-dried and rack-dried swatches of experiment 4, Table XIII. In this figure the rack-dried values are the reference points, and differences between the two drying methods in scores and in wrinklemeter readings are represented by the lengths of the bars. Disagreement in scores and wrinklemeter measurements in eight of the 14 fabrics is apparent.

A possible explanation of disagreements in results of the two methods noted throughout this part of the study may be that the wrinklemeter values are a mean of the readings of the portions of the fabric appearing on the stage of the instrument for measuring in each position, while the judges see a complete swatch and evaluate it as a whole, making their own subjective integration. Thus the judges may be influenced unduly by the deepest crease or wrinkle, while the wrinklemeter measures it as a part of the whole, if it happens to be measured at all.

Tumble-dried fabrics, often uniformly covered with myriads of minute creases, were rated by the judges as less wrinkled than those rack dried, which may have had fewer, but more pronounced creases. Yet the wrinklemeter readings were usually higher for fabrics tumble dried compared with those rack dried. It may also be possible that a napping effect was brought about on the face of some fabrics by tumbling, so that they presented fuzzy patterns to affect readings of the wrinklemeter, but not to influence judges' scores.

Judges scored fabrics according to their opinions of the need for pressing or ironing, without a common standard for comparison, and could have been influenced by psychological factors. The wrinklemeter measured the degree of wrinkling of the areas scanned, and its readings were affected only by the characteristics of the fabric. Judges were limited to a one- to five-point scale, while the meter scale ranged from 0.00 to 99.00.

Until subjective scoring and degree of wrinkling as measured by the meter can be more significantly related, each method of evaluation will need to be employed according to the objective of the project.

On the basis of the experiences encountered in this study, the designers of the wrinklemeter have made some changes in the instrument. More measurements are possible with the modified instrument than with the original. The modified wrinklemeter was used in work reported in the 1959 Intersectional Contest as the contribution of the Washington Section, AATCC (3). This committee found "remarkably good" correlation between results of subjective methods of judging with reference standards and measurements with the modified wrinklemeter.

CREASE-RECOVERY MEASUREMENTS—— Crease recovery angles of selected fabrics after nine launderings were measured to determine whether there was any relationship between the crease-recovery angle and the wrinkling of fabrics as measured by visual observations and by a wrinklemeter. If a definite relationship could be found between judges' scores of wrinkling and crease-recovery angles, the measurements of the latter could be used as an objective method for evaluating wrinkling effects of different laundering treatments.

Much of the literature reporting studies involving crease-recovery angles concerns the effectiveness of resin treatment of cottons. Lawrence and Phillips (4) gave a figure of 275° original and 240° after five home launderings as the maximum recovery angles to strive for, but pointed out that these measures could not be relied on alone as fabric performance indicators. Simpson (5) reported that a finish that can give wrinkle-recovery angles of 250° is generally considered a good crease-resistant finish. Krumholz (6) gave "at least a 230° angle of recovery" as a minimum for good appearance, and classed wrinkle recovery of fabrics as a property which influences "freshness" and "apparent age."

Reid (7) said that most "wash-and-wear" fabrics do have a good crease-recovery angle, but it does not correlate with "wash-and-wear" qualities. Lawrence and Phillips (4) found good agreement between subjective evaluation of fabric appearance and crease-recovery angles of "wash-and-wear" fabrics, both before laundering and after five home launderings. Williams (8), speaking of "wash-and-wear" cottons, stated that the psychological factor enters into judgments of appearance to such an extent that standards of "wash-and wear" cannot be based on wrinkle recovery alone. Goldstein (9), who compared tumble drying and indoor line drying as they affected wrinkling of resin-treated cottons, did not find a clear-cut pattern of results related to crease recovery. Golden, Stevens, and Richey, (10) also found disagreement between laboratory measurements of wrinkle recovery and subjective evaluations of appearance.

Only the fabrics from experimental unit 3, washed at three temperatures, were used in the crease-recovery study. These were selected because judges had given them a wide range of scores in evaluating the need for

ironing. If the temperature treatments had also made similar differences in the crease recovery of these fabrics, these data would show good correlation.

For 15 of the fabrics from 22 loads of the series a correlation coefficient was calculated for the scores given the swatches and the crease-recovery angles (warp plus filling) after nine launderings. Coefficients were as follows:

Fabric	Correlation Coefficient
A	−0.045
B	−0.191
E	+0.258
G	−0.073
H	+0.111
I	+0.223
J	+0.171
N	+0.056
O	−0.214
P	−0.251
R	−0.573
S	+0.204
U	+0.005
X	+0.139
Y	+0.306

Since better crease recovery is indicated as the angle of recovery increases and higher scores indicate less wrinkling, the coefficient would have a positive sign if the two increased and decreased concurrently. As is shown above, several of the correlation coefficients calculated were negative, notably for fabric R, the only one for which the coefficient was large enough to show significance of relationship.

These findings agree with the report of Reid and coworkers (7) who stated that crease-recovery angle is not a good measure of "wash-and-wear" qualities. Findings also agree with those of Golden et al (*10*).

Some of the crease-recovery measurements and visual judgments for 15 of the fabrics in this series were correlated in another manner as shown in Table XIV.

TABLE XIV

Mean scores of 15 fabrics after nine launderings in:	*Correlated with crease recovery measured:*	*Coefficient o correlation:*
One load washed and rinsed in 60° water in washer A	Originally	+0.484*
	After nine launderings	+0.571*
One load washed and rinsed in 60° water in washer B	Originally	+0.532*
	After nine launderings	+0.746**
One load washed and rinsed in 100° water in washer A	Originally	+0.148
	After nine launderings	+0.161
One load washed in 140° water and rinsed in 100° water in washer A	Originally	−0.085
	After nine launderings	−0.183
One load washed in 140° water and rinsed in 100° water in washer B	Originally	−0.092
	After nine launderings	−0.306

*Significant at the five-percent level of probability
**Significant at the one-percent level of probability

Since only with the cold-water wash was the coefficient of correlation significant, it indicated that for the fabrics given a cool laundering, crease-recovery measurements were a fair criterion of wrinkling response across a group of fabrics similarly treated. But with other washing temperatures, and within a fabric subjected to different treatments, crease recovery was of little use in evaluating differences between treatment effects.

In Table XV are given the means of the warp and of the filling crease-recovery angles for 10 of the fabrics in the series. Significant differences were noted in only eight of the 80 combinations—such a small number as not to merit further summary. In addition to means for treatment effects, Table XV gives the mean values of warp and filling angles combined across all treatments for each fabric after nine launderings. All combined recovery angles were greater than the 240° suggested (*4*) as the minimum to be indicative of "wash-and-wear" properties. Only in fabric P were any of the individual totals of warp and filling for any treatment less than 240°. Yet fabrics E, H, and N, for example, even when handled completely in cold water, were always given ratings which called for complete ironing.

Crease recovery measurements were correlated with wrinklemeter measurements after nine launderings of 22 of the swatches in 10 of the fabrics from experiment 3, with the following results:

Fabric	Correlation Coefficient
G	+0.314
I	−0.040
N	+0.525
O	+0.381
P	+0.267
R	+0.431
S	−0.194
U	+0.197
X	−0.110
Y	+0.024

None of the coefficients is large enough to indicate concurrency of wrinklemeter and crease-recovery measurements of treatment effects.

Because these data gave results which showed little value to the objective, no further analysis of such data from other series was made.

SUMMARY

Different laundering methods were studied as they affected the wrinkling of swatches of 27 "easy-care" fabrics of a variety of fibers and blends of fibers through nine launderings. All variables were evalu-

TABLE XV

Crease-recovery angles: Effect of washing temperature, rinsing temperature, and spinning time

Fabric	*Washing temperature*[1] 60°F	100°F	140°F	*Rinsing temperature*[2] 60°F	100°F	*Spinning time*[3] Normal	1/3	*Washer*[3] A	B	*Original*[3]	*Mean*[4] *warp plus filling after 9x*
WARP											
A	133.50a	134.46a	134.12a	133.67a	134.39a	134.22a	133.83a	137.39a	130.67b	141.2	
B	129.92b	141.54a	139.92a	137.53a	136.72a	138.61a	135.64a	136.44a	137.81a	154.4	
E	125.17a	124.71a	129.92a	127.61a	125.58a	125.11a	128.08a	122.50a	130.69b	137.8	
H	129.71a	133.92a	134.08a	131.11a	134.03a	133.25a	131.89a	132.83a	132.31a	136.8	
J	138.46a	134.75a	140.62a	136.67a	139.22a	139.17a	136.72a	138.44a	137.44a	145.0	
N	125.08a	127.00a	125.75a	125.00a	126.89a	126.42a	125.47a	126.50a	125.39a	146.0	
O	129.54a	127.96a	128.50a	126.36a	130.97a	128.97a	128.36a	127.81a	129.53a	136.6	
P	114.46a	111.50a	119.12a	116.28a	113.78a	116.75a	113.31a	114.78a	115.28a	101.2	
R	144.54a	146.00a	152.79a	145.08a	150.47a	147.25a	148.31a	148.50a	147.06a	162.4	
X	141.62a	138.83a	146.96a	140.53a	144.42a	144.39a	140.56a	144.28a	140.67b	154.8	
FILLING											
A	131.29a	133.96a	139.17a	132.58a	137.03b	137.28a	132.33a	134.03a	135.58a	136.2	268.8
B	135.83a	133.88a	138.54a	134.39a	137.78a	136.61a	135.56a	136.39a	135.78a	133.6	273.2
E	134.12a	130.25a	137.00a	132.61a	134.97a	135.39a	132.19a	132.64a	134.94a	133.6	260.4
H	129.21a	128.62a	128.83a	128.67a	129.11a	127.56a	130.22b	128.39a	129.39a	124.8	261.5
J	142.88a	140.46a	145.54a	142.08a	143.83a	144.31a	141.61a	143.56a	142.36a	148.6	280.9
N	148.38a	145.04a	148.96a	146.94a	147.97a	146.75a	148.17a	148.33a	146.58a	156.2	273.3
O	137.00a	137.75a	142.33a	138.56a	139.50a	138.22a	139.83a	139.47a	138.58a	142.8	267.7
P	121.88a	124.88a	130.75a	124.47a	127.19a	129.03a	122.64a	125.83a	125.83a	117.6	240.8
R	149.96a	151.33a	155.71b	152.53a	152.14a	154.00a	150.67a	151.25a	153.42a	160.8	300.1
X	142.00a	142.21a	143.67a	142.53a	142.72a	144.89a	140.36b	142.56a	142.69a	149.8	285.1

Note: Data for a fabric marked with the same superscript within a variable were not significantly different at the five-percent level of probability.
[1] [2] [3] [4]Mean of 24, 36, 5, and 72 values respectively.

ated by subjective judgments of need of ironing the swatches. Wrinklemeter measurements were made of the wrinkling of the swatches after selected laundering procedures. For some swatches, angles of crease recovery were determined.

According to subjective evaluation, variables studied which left fabrics with least wrinkling were 60°F washing temperatures rather than 100°F, 100°F rather than 140°F; five-pound rather than seven-pound load, rack dried; tumble drying rather than rack drying if full washer cycle was used; and drip drying rather than tumble drying if no water was extracted.

There were trends for less wrinkling from four minutes of agitation rather than eight; agitation at regular speed rather than slow; spin time shortened to 1/3 rather than full spin time; 60°F rinse rather than 100°F; three-pound load rather than five- or seven-pound, if rack or tumble dried; tumble-drying temperature of 150°F rather than 130° or 180°F (all ± 10°F); and tumbling without heat for 10 minutes after drying was complete compared with no tumbling after drying.

Variables which made little difference in the wrinkling were type of washer; hand or machine washing with no water extraction; cooling 100°F wash water to 65°F before extracting water, and rinsing at 60°F compared with allowing washer to proceed through normal spin followed by 60°F rinse; normal or slow spinning speed; 130° or 180°F tumble drying; and tumbling without heat for 10 or for 20 minutes after drying was complete.

In comparative wrinkling results, wrinklemeter readings and judges' scores did not always agree. The chief disagreement was in fabrics rack and tumble dried; the wrinklemeter readings showed some fabrics more wrinkled when tumble dried than when rack dried, but the judges considered these same fabrics less wrinkled when tumble dried. These results indicate a need for further work in this area in order to use the wrinklemeter measurements in predicting consumer judgments.

In general, crease-recovery measurements correlated poorly with judgments of amount of wrinkling and with wrinklemeter readings, and were considered of no value in comparing the wrinkling results from the different treatments.

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LITERATURE CITED

(1) Hunter, Richard S, and Lofland, Clyde A, "Optical Wrinklemeter" *Am Dyestuff Reptr 48*, No. 8, 54-8 (1959).
(2) American Society for Testing Materials, "ASTM Standards on Textile Materials (with related information)" 766 pp, 1956.
(3) Washington Section, American Association of Textile Chemists and Colorists, "Wash-and-Wear Ratings: Subjective and Objective" *Am Dyestuff Reptr 48*, No. 21, 57-62 (1959).
(4) Lawrence, E W, and Phillips, R H, "'Wash-and-Wear' Fabrics", *ibid 45*, No. 17, 548-50, 561 (1956).
(5) Simpson, B G, "The Effect of Silicone Softeners on Resin-treated Cottons", *The Sixth Chemical Finishing Conference Report*, National Cotton Council of America, Washington, DC, 36-45 (1957).
(6) Krumholz Jr, George, "Testing and Evaluation of 'Wash-and-Wear' Properties." *Modern Textiles 39*, No. 7, 51-4 (1958).
(7) Reid, J D, Reinhardt, R M, Kopacz, B M, and Fiori, L A, "'Wash-and-Wear': Progress and Problems" *Textile Inds 122*, No. 11, 90-8 (1958).
(8) Williams, Charles R, "Mechanisms Influencing the 'Wash-and-Wear' Characteristics of Cellulosic Fabrics" *Am Dyestuff Reptr 48*, No. 13, 27-30, 39 (1959).
(9) Goldstein, Ruth E, "A Comparison of the Effects of Tumbler Drying and Line Drying on Resin-treated Cotton." MS Thesis, College of Home Economics, Drexel Institute of Technology, Philadelphia, 1958.
(10) Golden, Jewel, Stevens, Hazel T, and Richey, Helen L, "Performance of Selected Resin-treated Percales" *Am Dyestuff Reptr 48*, No. 17, 29-35 (1959).

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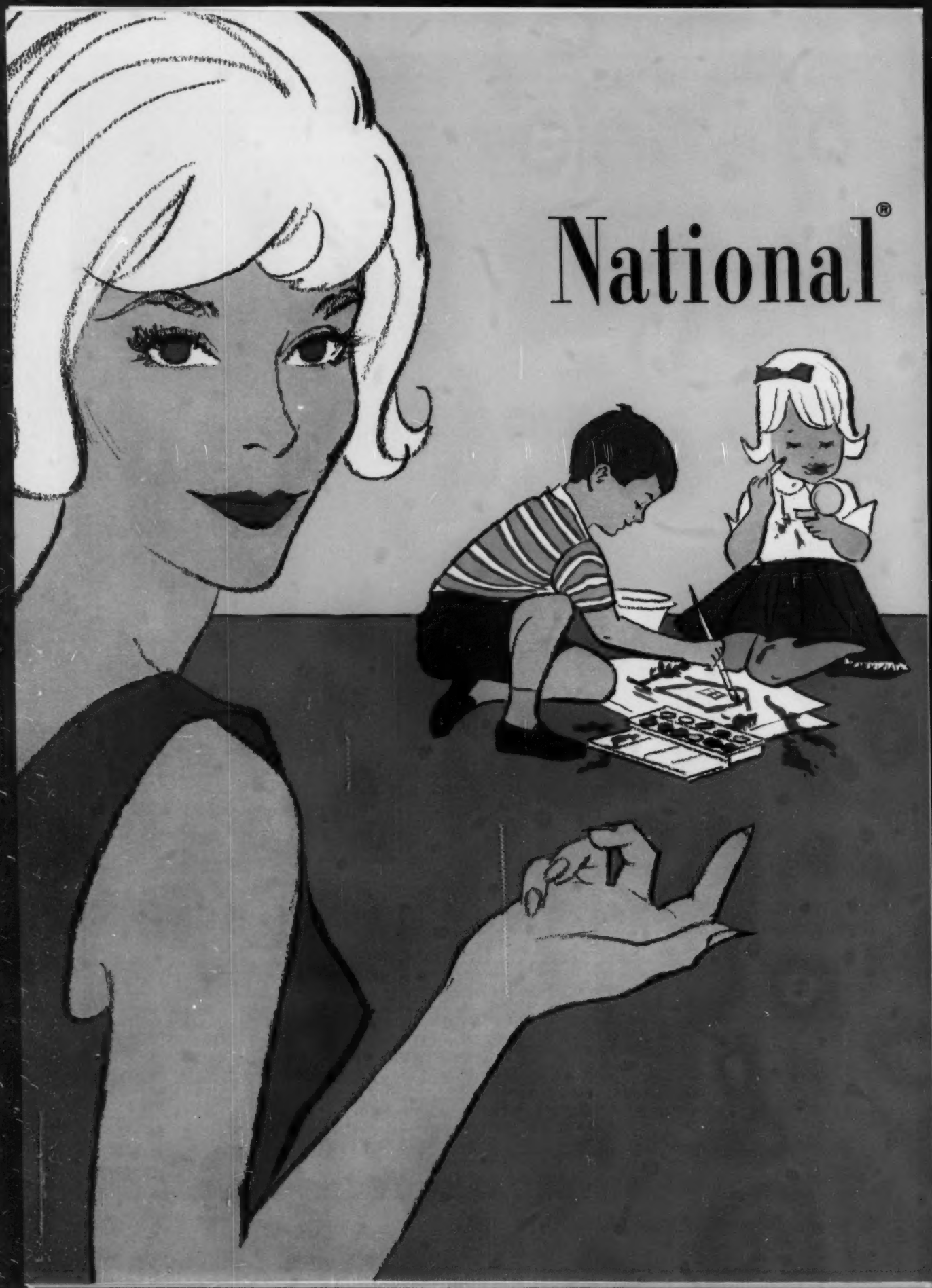
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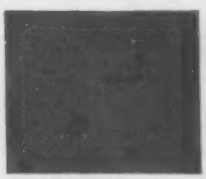

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In the relatively short span of the past ten years, the commercial dyer has been compelled to process a continuous procession of new synthetic fibers. To complicate this situation still further, the trend has been to use these synthetic fibers in blends with other synthetics, or in combination with natural fibers.

A review of the classes of dyes recommended for the fast dyeing of protein fiber and polyamides, and the new classes of modified acrylics, acrylic alloys, nytrils and polyvinyl alcohols, discloses that the 2:1 neutral-dyeing prometallized dyes, also relatively newly introduced in the past ten years, have outstanding fastness properties combined with simplicity of application.

This paper discusses the problems involved in union dyeing blends of any two of these fiber classes in the same dyebath with the 2:1 neutral-dyeing prometallized dyes, and specific combinations are investigated as important illustrations. Relationships, relative to the partition of dye between fibers of these combinations as effected by varying pH, and with no auxiliaries present in the dyebath, are plotted. Also, the effect on this partition by selected auxiliaries is illustrated. An analysis is made of the significant factors and variables to be considered in this type of union dyeing.

Union dyeing of the above classes of synthetic and natural fibers with 2:1 prometallized dyes is now possible although for many shades difficult to achieve. The need for more specifically tailored auxiliaries than now available is indicated. Also, more knowledge is needed relative to the auxiliaries' exact behavior in the dyebath at all temperatures, and under varying conditions of electrolyte concentration and pH.

INTRODUCTION

WITH the introduction of each new synthetic fiber, the field of union dyeing assumes greater importance. With each passing year, the industrial colorist is compelled to process an increasing number of new fiber blends. As each new fiber is introduced, it multiplies the variability that may be obtained by fiber combinations, and as the dyer is not an initiator of fabrics or fashions, he must be in a position to be able to process whatever may come his way.

In the past, union dyeing of batch lots in a single bath has been successfully accomplished by a) the use of selective dyes for each fiber, as for example, direct and disperse dyes for viscose rayon and cellulose acetate, and acid and basic dyes for wool and Orlon; or b) by using a combination of dyes, one or more selective to both fibers to varying degree and one or more dyes mainly selective to only one of the fibers, as with the dyeing of nylon and cellulose acetate with disperse and acid dyes, and as recommended for union dyeing wool and Zefran, 2:1 neutral-dyeing metallized dyes† and selected milling colors.

The future of the dyeing industry lies in the direction of more rapid dyeing methods, with greater control, and with results of higher standards of excellence. It therefore occurred to the Committee to investigate the practicability and the problems involved in union dyeing various fiber combinations in which each fiber has a high affinity for 2:1 NDM dyes. Not only would these dyes have high affinity for each fiber, but they would be nonleveling beyond a small degree under recommended dyebath conditons.

The ultimate to be achieved in union dyeing is where the dyes are exhausted onto each fiber in a controlled fashion so that, at the end of a short dyeing cycle, each fiber is dyed to equal depth and shade, and well penetrated. This result cannot now be achieved with the exclusive use of 2:1 NDM dyes. In fact, as of this date, the risk of a poor union and unlevelness is too great to be attempted in yarn or fabric form for several important fiber combinations. It must be kept in mind that, with the use of 2:1 NDM dyes, once the dye is on the fiber, starting far below the boil, there is where it substantially remains, unless a radical change is made that is beyond practical dyebath limitations.

The urgency to investigate this type of union dyeing is further compelled by the introduction of synthetic fibers which require for best all-round properties the use of 2:1 NDM dyes.

Only limited formulation gained from previous experience with one blend of fibers can be carried over to solve the problems of another blend. Although dyeing is a unit process in textile processing, similar to the unit processes encountered in chemical practice, the study of the dyeing phenomena is at the present day still not an exact science, as is well known, but is mainly an experimental science. Any dyeing theories formulated never go beyond the experimentally established facts. We are therefore faced with the necessity of making a number of simplifying assumptions in order to understand and apply our experience. Even then, the most important developments are products of sound logical deductions and interpretation of experimental facts.

*Presented by Bennett S Gesmer on October 7, 1960 at the Sheraton Hotel, Philadelphia, Pa

†Hereafter "2:1 neutral-dyeing metallized dyes" is abbreviated to "2:1 NDM dyes".

DISCUSSION

2:1 NDM DYES—GENERAL—— The 2:1 NDM dyes are assuming ever-greater importance. In comparison with the various classes of dyes applicable to textile fibers, these relatively recently introduced neutral-dyeing 2:1 metal complex dyes offer advantages in application and end use. These dyes combine simplicity of application with unexcelled fastness properties on wool, nylon and an ever-increasing number of synthetic fibers. However, the degree of affinity of 2:1 NDM dyes varies from fiber class to fiber class, and the fastness properties, although high, are correspondently different. Table I lists the washfastness and lightfastness of several 2:1 NDM dyes on a modified acrylic, an acrylic or nitrile alloy, a polyamid and wool.

From Table I it can be seen that the fastness properties are of such a high order that under ordinary dyebath procedure there would be very little equalizing of the dye once unevenly applied to the fibers, and the prospects of leveling a union dyeing not very promising where there is an unbalanced and uneven partition of dye. Figure 1 illustrates the negligible dye transfer that is obtained if the modified acrylic, Creslan, is boiled at various pHs with a dyed sample of wool, dyed with 2% CI Acid Brown 45. With other classes of dyes there would be a migration of dye from the wool to the Creslan.

As shown in Table I, the 2:1 NDM dyes offer definite advantages, however, with the simultaneous dyeing of two different fibers in the same dyebath with these dyes, the partition of dye is rarely equal, and we are faced with the disadvantage of a difficult control problem relative to dye uptake on each fiber.

2:1 NDM DYES—SPECIFIC—— The 2:1 NDM dyes are not strictly neutral-dyeing colors. Although solubilized with sulphonyl groups (SO_2 · Alk or SO_2 · NH_2), and not sulfonic acid groups, they do possess acidic character, and are strongly influenced by pH. In the ACS monograph "The Chemistry of Synthetic Dyes and Pigments", edited by H A Lubs and published in 1955, there is little information on this class of dyes. The best source of information on the chemical nature of this class of dyes is in the patent literature. The dyes mainly consist of two azo dyes complexed with one metal atom, and they are generally produced in the form of the sodium salt. The complexed metal may be chromium, cobalt, nickel, copper or other metal atom, but despite this difference, they have very similar dyeing behavior. There are unique exceptions, of course.

TABLE I

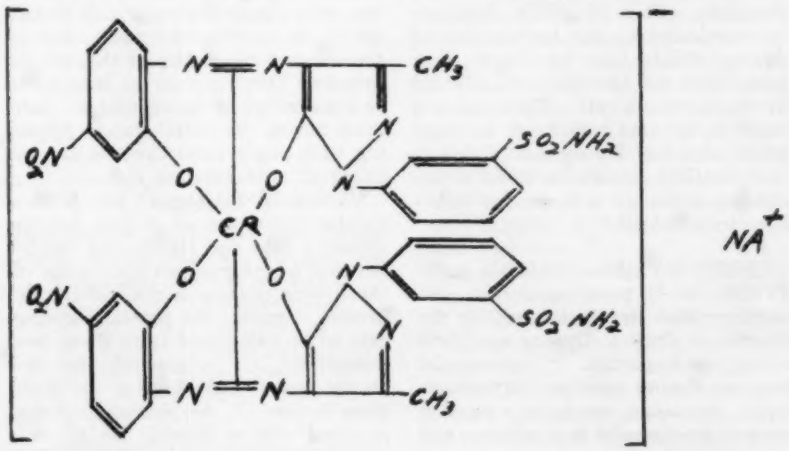
Fastness ratings of several 2:1 NDM dyes on several fiber classes

	Modified acrylic		*Nitrile alloy*		*Polyamid*		*Wool*	
	W	*L*	*W*	*L*	*W*	*L*	*W*	*L*
CI Acid Yellow 114	5	7-8	4	5-6	5	6-7	5	6-7
CI Acid Orange 86	4-5	7-8	5	6-7	5	6-7	5	7
CI Acid Red 218	5	7-8	4	5-6	5	7	5	7
CI Acid Violet 75	5	7-8	5	6-7	5	6-7	5	6-7
CI Acid Blue 168	4-5	7	4	4-5	5	6-7	5	6-7
CI Acid Green 43	5	7	5	5-6	5	7	5	6-7
CI Acid Brown 28	4-5	7-8	5	5-6	5	7	5	7
CI Acid Black 60	4-5	7-8	5	6-7	5	7	5	7

Note: Under each class, the column on the left refers to the washfastness, and the column on the right to the lightfastness (AATCC test methods).

The 2:1 NDM dyes are old but their successful application to textile fibers is relatively new (*1*). The metal complexes of O,O'-dihydroxyazo dyes date back to 1900, when a copper complex was prepared. A U S patent (*2*) issued in 1927 to Ciba discloses Neolan Orange R (CI Acid Orange 76) to be a neutral-dyeing metallized dye. However, as it was too hydrophilic for neutral application, it is used with the 1:1 metal to dye complex dyes, and applied to wool with sulfuric acid. In 1940, I G Farben was issued an Italian patent (*3*) for the use of 2:1 NDM dyes to dye superpolyamides and polyurethanes at elevated temperatures. In 1945, DuPont was issued a patent (*4*) for dyeing nylon with those complexes having low water solubility. 2:1 NDM dyes have limited solubility in water due to their hydrophobic nature.

World War II prevented the commercialization of the 2:1 NDM dyes. In 1949, Geigy introduced Polar Gray BL (the first of the line later called Irgalans, and in 1950 DuPont brought out its first six Neutracyl (now Capracyl) dyes. The structure of CI Acid Red 38 (CI 18880), a typical 2:1 NDM dye, is indicated below:



On wool, the 2:1 NDM dyes give very level dyeings, with a slow and even rate of adsorption when dyed neutral. As the pH is lowered, the rate of dyeing increases with a corresponding decrease in migration properties. On nylon, the majority of 2:1 NDM dyes strike rapidly when dyed neutral. (See Figure 3). Increasing the pH to 8 or above slows down the rate only moderately. There is no tendency for dye migration, and the washfastness properties are of the highest order. Although the fastness and building-up properties on nylon are excellent, the 2:1 NDM dyes are very sensitive to variations in the physical structure, and this is reflected in the rate of dyeing being very greatly affected by variations in the physical structure. This would be of greatest significance in the dyeing of filament nylon.

On a modified acrylic, such as Creslan, the 2:1 NDM dyes have a good buildup with excellent fastness properties. There is a tendency for the dyes to migrate slightly, and this tendency varies in degree with each dye. The dyes have a tendency to strike at 170° to 190°F, and this presents a problem of control of temperature rise. Preliminary investigation has shown that there is a tendency to ring dye under all dyebath conditions, although his has no effect on fastness properties.

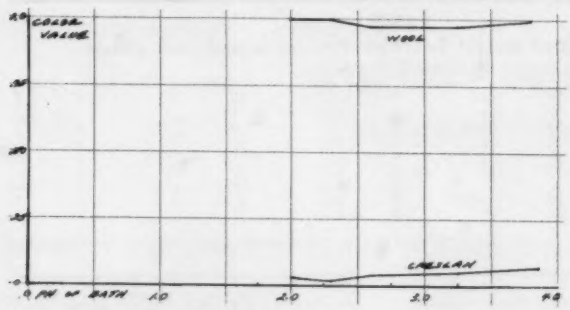


Figure 1
Effect of pH on migration of 2% CI Acid Brown from wool to Creslan. 30-minute boil.

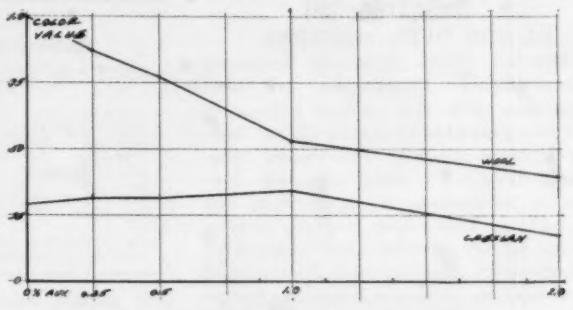


Figure 2
Effect of the presence of a cationic auxiliary during dyeing upon dye distribution between wool and Creslan. 2% CI Acid Black 58.

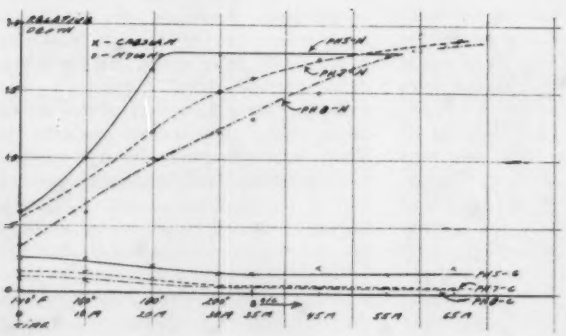


Figure 3
Dye vs pH

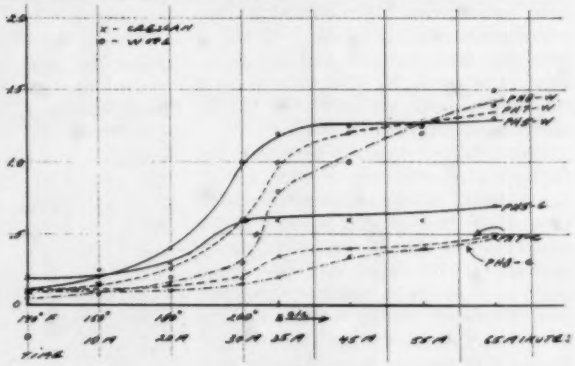


Figure 4
Dye vs pH

On a nitrile alloy, or acrylic alloy, such as Zefran, the pH has little effect on the dyeing rate of 2:1 NDM dyes. These dyes have a high strike at low temperature (see Figures 5 and 6), but they have a tendency to an even rate of adsorption thereafter with temperature rise. The addition of a salt electrolyte increases the dyeing rate on Zefran in a manner similar to direct dyes on a cellulosic fiber.

With dyeing characteristics similar to Zefran is Vinal, one of the newest fiber classes to appear industrially. The 2:1 NDM dyes are recommended as the best means of dyeing Vinal. The 2:1 NDM dyes, with Vinal, are likewise little affected by variation in pH. They have a rapid strike, and retardants are recommended for this control. Table II lists the fiber classes discussed in ascending order of average dye affinity (strike) at pH 5.

TABLE II

Relative affinity (strike) of fiber classes at 150°F, pH 5, in ascending order

ZEFRAN (acrylic alloy)
↑
VINAL
↑
NYLON
↑
WOOL
↑
CRESLAN (modified acrylic)
↑
ACRILAN (acrylic)

UNION DYEING—DYEING KINETICS——It is necessary in discussing union dyeing to consider the kinetics of dyeing. Dyeing equilibria is not as important in commercial work as dyeing kinetics. In the case under discussion, we have a class of dyes of intrinsically high affinity, and little or no migrating tendency. A nonleveling dye with a high strike in the early stages of dyeing will always result in an unlevel dyeing, due to the mechanical nature of the dyeing process. There can be no inequality of dye adsorption throughout the fiber mass during the initial stages of dyeing with nonleveling dyes, as can be tolerated with leveling dyes.

Vickerstaff (5) states "The fundamental properties of a dye are its diffusion rate and affinity for the fiber, but at the moment knowledge of the dyeing process is not sufficiently precise to enable the practical dyeing rate to be calculated from these two quantities . . . In general, the observed rates will depend on both these factors . . . An indication of the practical rate of dyeing can be obtained only from measurements made under conditions approaching as closely as possible to those used in practice . . . Leaving aside the question of temperature, the rate is governed by mechanical factors . . . the dyebath volume or liquor ratio, and the rate of agitation or circulation, and by the affinity of the dye, together with the dye concentration, the pH, and electrolyte content of the dyebath."

Vickerstaff lists three stages of dyeing, involving dyeing kinetics:

1) Diffusion of the dye through the aqueous dyebath to the surface of the fiber.
2) Adsorption of the dye on the outer surface of the fiber.
3) Diffusion of the dye inside the fiber from the surface towards the center.

The stage mainly concerned with in this paper is No. 2, the adsorption of dye on the outer surface of the fiber. This is one of the simplifying assumptions referred to earlier in the paper, and we are at present neglecting or ignoring any implications of ring dyeing and fiber penetration.

UNION DYEING — DYEBATH AUXILIARIES——The union dyeing of two different fibers with dyes

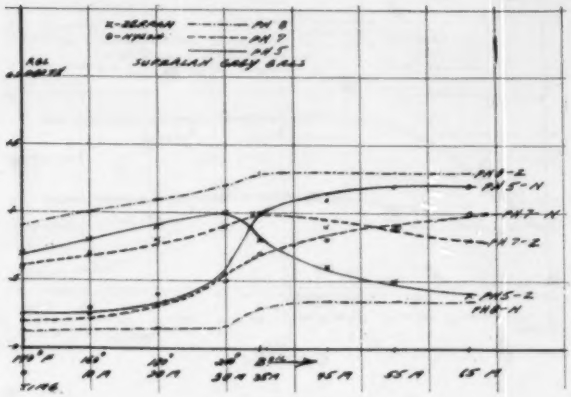


Figure 5
Dye vs pH

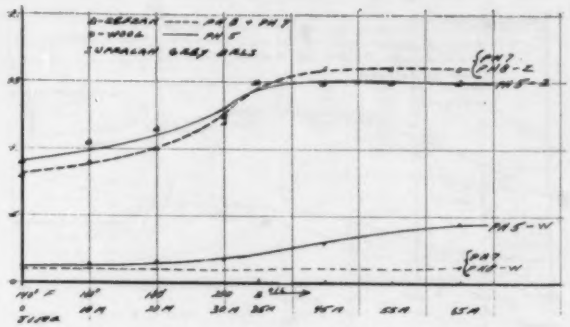


Figure 6
Dye vs pH

of high affinity and little or no migrating ability, leads, as an only source of achieving satisfactory results, to the use of dyebath auxiliaries. The study of dyebath auxiliaries is a scientific and technical field that only in recent years has been studied in great detail.

The first investigation into this subject was done by Valko (*6*), who showed that nonionic auxiliaries greatly reduced the rate of diffusion of dyes in solution. He explained this by saying that the dye had increased in particle size by forming dye and auxiliary aggregates. More recently, it has been shown that there is a spectral shift which occurs in solution of a dye when there is a formation of a complex between a dye and an auxiliary. In the case of a dye-auxiliary addition complex, the equilibrium constant has been defined (*7*) as equal to the concentration of auxiliary agent at which half of the dye is in the form of the addition complex. This constant changes with temperature and pH, increasing with increase of temperature, decreasing with increase of pH. According to Luck (*8*), the concentration of free dye will be reduced by the auxiliary agent, and the quantity of dye adsorbed on the surface of the fiber will be diminshed according to the Nernst partition law.

As a dyeing progresses, the ratio of auxiliary to dye increases by manyfold. For example, 1% of a dye with 1% of a nonsubstantive auxiliary is a ratio of 1:1. As the dyeing proceeds, and dye is removed from the dyebath, this ratio increases, until, when 90% of the dye is on the fiber, the ratio of auxiliary to dye is 10:1. This is an increase of tenfold. Such a high ratio can give rise to poor color value, poor crockfastness, low dyebath exhaustion and, in the case of cationic auxiliaries, to scum formation. However, this increase in ratio has the advantage in that it can compensate for the larger equilibrium constant required at high temperature. Figure 2 (*10*) illustrates the effect of a cationic auxiliary on the partition of a dye, CI Acid Black 58, between wool and Creslan, and the effect on the dyebath exhaustion.

A large majority of dyebath auxiliaries are not capable of forming dye-auxiliary complexes with the affinity for dyes, and with an equilibrium constant, of practical importance in the union dyeing of two fibers with the 2:1 NDM dyes. Dyebath auxiliaries can form loose addition compounds with the dye, or water-soluble dye-auxiliary complexes of high affinity. Some of the dyestuff-auxiliary complexes are tightly held by the fibers, and this can lead to poor fastness properties, as previously discussed. Nonionic auxiliaries are strongly affected by anion-active agents, and in many cases their effect is completely counteracted.

One of the complicating properties of auxiliaries, and the restraining or retarding action they produce, is the minimum-activity effect. As shown by Lister (*9*), the minimum-activity effect is most marked with 2:1 NDM dyes. Table III is given as an example.

TABLE III

Exhaustion of 1% CI Acid Brown 20 on 100% Acrilan, with 4% Lyogen WA, after one hour at the boil

Equilibrium pH	*Exhaustion of dyebath* (%)
6.50	27.6
6.34	16.7
5.12	5.7
4.28	100.0
3.80	100.0
3.09	75.5
2.82	61.6
2.50	54.6

UNION DYEING—ACRILAN-WOOL REVIEW——It would be instructive to review briefly the first work done on the union dyeing of two fiber classes with 2:1 NDM dyes. The union dyeing of Acrilan and wool blends with 2:1 NDM dyes was the first to be seriously investigated. The fundamental component of Acrilan is weakly basic and requires strong acid for dyeing, while the basic amine groups in wool are relatively strong, and are dyeable in the presence of weak acid. The problem as stated was that higher acidity and higher temperature are required to effect optimum dye exhaustion on Acrilan. The union dyeing was attempted by the following methods:

1) The use of 8 to 12% sulfuric acid at the boil, to transfer the dye from the wool to the Acrilan. (Not applicable with 2:1 NDM dyes).
2) The use of 5 to 7% sulfuric acid with a cation-active auxiliary to help transfer the dye to the Acrilan. This method includes all classes of dye except 2:1 NDM dyes, as they do not transfer once adsorbed on the wool.
3) Acid pretreatment and the use of a nonionic auxiliary. Under these conditions Acrilan adsorbs more dye than does the wool at low temperatures. Above 140°F, the dyeing rate of the wool increases sufficiently to bring the fibers into union. For 2:1 NDM dyes, no more than 4% sulfuric acid is necessary in the 30 minutes pretreatment.
4) The use of a dye-cation auxiliary complex dispersed with a nonionic auxiliary.

The advantages and limitations of method 4 are listed as follows:

a) The effect of the cationic auxiliary is not a straight line function of the concentration.
b) The quantity of sulfuric acid is critical for a union.
c) Time, in relation to sulfuric

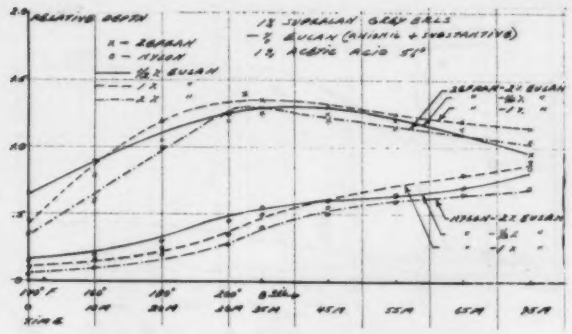


Figure 7

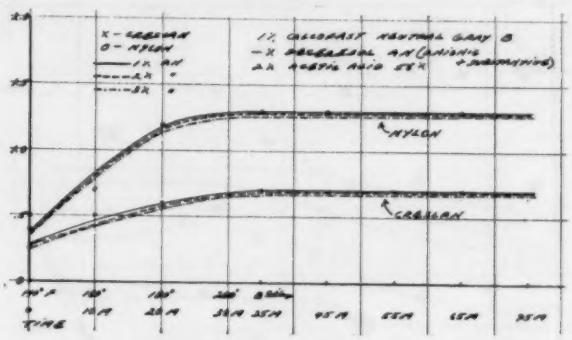


Figure 8

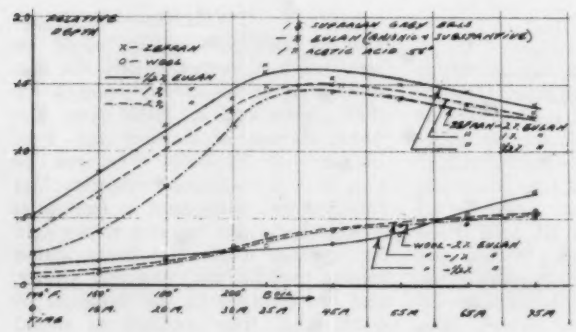


Figure 9

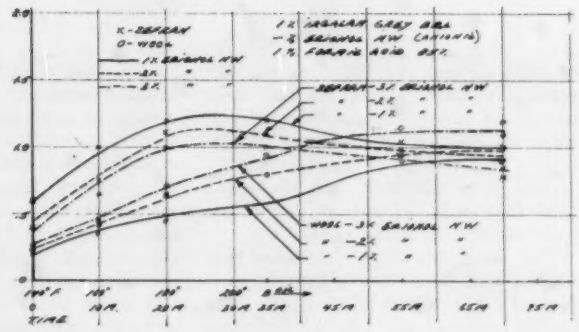


Figure 10

acid and the cationic auxiliary, is important in controlling dye balance.

d) The cationic auxiliary retards the dyeing of wool during the initial period of dyeing.

e) The cationic auxiliary controls the rate of dyeing.

f) Selection of dye is important. Some dyes will not complex with the auxiliary, while others not in combination. Some dyes require 0.5% sulfuric acid, while others 12.0%. Each dye has an individual acid requirement. Dyes of different acid requirements can not be mixed.

g) Shades of widely varying depths require different amounts of sulfuric acid, depending on depth of shade.

EXPERIMENTAL

DYEBATH FACTORS AND EFFECTS——An analysis of the factors involved in the union dyeing of two fibers must first consider the main effects of dye, temperature, time, pH, or acid concentration, and any dyeing auxiliary concentration. The dependent variables to these main effects that must be considered are the color *value* on each fiber, the *levelness* on each fiber, and the *union*. A coefficient of variance can thus be found for the following relations of the main effects and interactions on the union, and the levelness and color value of each fiber:

Main Effects:

Dye
Auxiliary
pH
Time
Temperature

Interactions:

Dye vs Auxiliary
Dye vs pH
Dye vs Time
Dye vs Temperature
Auxiliary vs pH
Auxiliary vs Time
Auxiliary vs Temperature
pH vs Time
pH vs Temperature
Time vs Temperature

For the experimental purposes of this paper, the investigation was carried out in two phases. In the first phase, all the main effects were set except the pH values. This gave, as the only variable to be considered, union vs pH. The levelness and color values were not considered. Actually, in bulk work, these two variables would be of prime importance. The relations of the interactions on the dependent variables of union, levelness and color value, were likewise not considered, as not being applicable. In all cases of the dyeings, the bath ratio was 50:1, and the temperature rise 2.5°F/minute to the boil, this being a similation to bulk practice.

For the second phase of the investigation, the pH was set, and the only variable considered that of union vs auxiliary.

EXPERIMENTAL PLAN —— In order to investigate the dyeing behavior of 2:1 NDM dyes in dyeing fiber blends, the Committee has taken several combinations that represent those being currently introduced in the trade. These are: Creslan, a modified acrylic, with nylon and with wool; and Zefran, an acrylic nitrile alloy, with nylon and with wool. The dyeing behaviors of Creslan and Zefran are basically different.

Figures 3 through 6 illustrate the rates of dyeing, and partition of dye, of the above listed fiber combinations at pH levels of 5, 7 and 8, with all other main effects set, and with no auxiliary in the dyebath. These show the general relationship, and relative fiber affinity, affected by the varying pH.

Figures 7 through 12 illustrate the effect on the dyeing rates, and union,

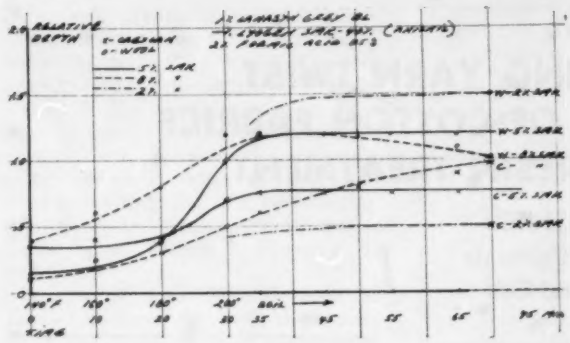


Figure 11

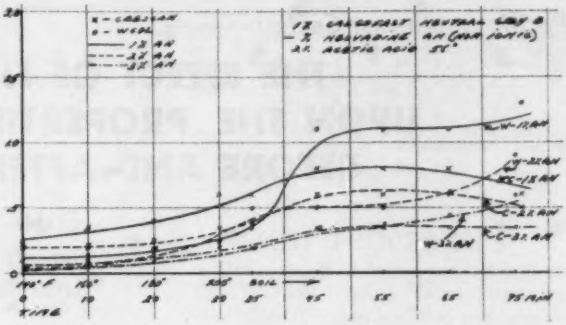


Figure 12

of several carefully selected auxiliaries at different levels of concentration, with all other main effects set.

DISCUSSION OF RESULTS——
While the dyeing of the classes of fibers previously discussed in this paper can be readily and successfully dyed with 2:1 NDM dyes in a dyebath alone, the union dyeing of any two together presents a difficult dyeing problem. Beside the fact that for many dyes the same percent on two different fibers gives different relative depths or color value, and different casts of shade, the problem of balancing the dye for equal partition is complicated by the individual variance, predictable and unpredictable, of every dye, alone or in combination.

The Committee has carefully selected several auxiliaries, and Figures 7 through 12 illustrate their effect on the union, or dye partition, of the fiber combinations considered. Careful study of these graphs will disclose a good deal of significant information, and a comparison of Figures 3 to 6 with those of 7 to 12 will indicate the striking and significant effects of the auxiliaries investigated. Several of the auxiliaries are not capable of forming dye-auxiliary complexes, but are substantive to one or both of the fiber classes investigated. These are shown for comparison purposes. (See Figures 7, 8, and 9.) They also illustrate one method of achieving a union, by blocking of dye sites.

In order to give more meaning to these graphs, we have thought it advisable to use the trade names of the dyes and the auxiliaries used, and have so indicated them on the graphs. These auxiliaries in no way represent the best or only ones that can be used to approach a union. We have only tried to indicate the different effects that various carefully selected auxiliaries can have on the union dyeing of two fiber classes with 2:1 NDM dyes. Each auxiliary was chosen to illustrate the significant effect of the general type to which it belongs.

CONCLUSION

The union dyeing of fiber blends with 2:1 NDM dyes is a present-day problem yet to be fully and satisfactorily solved. For success with this type of union dyeing, it is necessary for the colorist to control to closer limits the factors of the dyebath . . . dye concentration, pH, auxiliary concentration, temperature and electrolyte concentration. The matching of shades is hazardous, and critical, as the 2:1 NDM dyes are nonleveling and difficult to apply to the new fiber classes in union.

The solution to this problem lies in the refinement of the dyeing process. Also, more exact knowledge is required of the behavior of dyebath auxiliaries under varying dyebath conditions. Although the dyeing phenomena is not an exact science, we are nevertheless entering a period in textile technology where more *exact* dyebath control is demanded for successful results.

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J Leininger of the Fibers Div, American Cyanamid Co, for his encouragement, and help in obtaining permission to use results of his investigations.

LITERATURE CITED

(1) Condensation of a report to the Committee by J F Laucius, Process Div, Chemical Control Dept, Chambers Works, E I duPont de Nemours & Co, Inc, dated July 29, 1960.
(2) U S Pat 1,623,005 (Ciba/1927).
(3) Italian Pat 378,566 (I G Farbenindustrie AG/1940).
(4) Kvalnes, D E, and Carson, B G, U S Pat 2,374,106 (DuPont/1945).
(5) Vickerstaff, T, "The Physical Chemistry of Dyeing", 2nd ed, Chapter V (1954).
(6) Valko, E, *J Soc Dyers & Col* 55, 173 (1939).
(7) Luck, W, Society of Dyers & Colourists, Proceedings of symposium held at Buxton, September, 1957.
(8) Luck, W, ibid.
(9) Lister, G H, ibid.
(10) Leininger, J, private communication (June, 1960).

OPENINGS IN '61 CONVENTION TECHNICAL PROGRAM

PERSONS or organizations wishing to present papers at the 1961 AATCC Convention in Buffalo are invited to contact Thomas R Foltz, Technical Program Chairman, at Lockport Felt Co, Newfane, NY.

Pacific Southwest Section———

THE EFFECT OF FILLING YARN TWIST UPON THE PROPERTIES OF COTTON FABRICS BEFORE AND AFTER RESIN TREATMENT*

EDNA MESHKE[1]
University of California
Santa Barbara, Calif

The present investigation was an attempt to discover the effect of filling yarn twist upon the physical properties of cotton fabrics before and after resin finishing. Five samples of 24's cotton yarn, ranging from low to high twist, were spun and used for the filling in experimental fabrics of plain weave and average setts. The yarn with "average twist", highest strength, and least variability was used for two additional test fabrics; one of low sett and one of high sett. One half of the total length of fabric, representing seven test specimens, was tested for crimp, weight, thickness, tear strength and crease recovery and one half given an ethylene urea-formaldehyde resin treatment and the tests repeated. All fabric specimens decreased considerably in tear strength and increased in crease recovery following resin treatment. The optimum single strength yarn, when used for the filling in the "average sett", produced a fabric with highest tear strength and also best crease recovery. Handle and appearance ratings tended to favor fabrics of lowest filling yarn twist. Interpretations of test results indicate the importance of fabric geometry and the influence of yarn twist upon the properties of resin-treated cottons.

INTRODUCTION

THE treatment of cotton fabrics with solutions of resin-forming precondensates has been a finishing plant activity of considerable importance during the past decade. Reports of trials and tribulations and of difficulties and successes have furnished the substance for many printed pages in the periodical literature serving the textile industry. People all along the line: research scientists, plant technicians, and those involved in production, distribution, and consumption of cotton fabrics have been affected by (or at least alerted to) such newcomer phrases as "crease resistant", "drip-dry", and "wash-and-wear".

Cotton fabrics through finishing have acquired promotionally appealing properties. These have been studied critically both subjectively and scientifically. Each issue of the periodical literature devoted to textiles—whether semipopular or technical in nature—includes some comment, appraisal, interpretation, or item of fact pertaining to resin treatment of fabrics. Readers of *American Dyestuff Reporter* are well aware of this and of the general points of agreement: resin treatments lead to changes in fabric properties, particularly those related to wrinkle resistance, crease recovery, strength, and handle. The extent to which fabric properties may be affected appreciably is reported to be due to such factors as the particular resin formulation, the curing temperature and time, the catalyst, softener, and afterwash. However, since the present study was not designed to deal with the effectiveness of resin finishing per se, a review of the cumulative literature on the subject is not specifically applicable. But the cumulation reports, both in nature and quantity, do justify the assumption that an ever-increasing amount of cotton yardage is destined for resin finishing. This prospect suggests consideration of the total fabric structure; the nature of the goods that come from the loom and are delivered to the converter.

Individual cotton fibers, each with natural inherent properties, are not subjected to resin finishing as independent units. Fibers become members of a group (a yarn) and these groups (yarns) become members of a larger group (interlaced warp and filling yarns). In actual fabric construction, many cotton fibers are in contact with others in a finely drawn and twisted strand, the yarn. Subsequently, many similarly composed and constructed strands (yarns) are interlaced with varying degrees of compactness. (Woven with low, average, high setts). Consequently it appears evident that the arrangement, location, and packing of cotton fibers in a yarn and the relative proximity of these yarns in a fabric will have a relationship to the susceptibility of a fabric to wet processing. The present study was undertaken to test the foregoing assumption. The specific purpose was to discover whether the use of cotton yarns —ranging from low to high twist—in low, average, and high filling setts would create differences in basic fabric properties before and after resin treatment.

The work was done in the textile laboratories at the College of Science and Technology in Manchester, England, during a three-month period while the author was on a sabbatical leave from the University of California.

TABLE I
Characteristics of Five Yarns

Yarn	Twists per inch[a]	Count[b]	Twist factor[c]	Strength[d]	Rate of load
1	15.52	24.83	3.11	368	.058
2	16.72	24.12	3.40	405	.058
3	20.71	23.88	4.24	426	.058
4	23.32	22.84	4.88	430	.058
5	32.77	20.91	7.17	365	.058

[a]TPI—based upon 150 one-inch samples of each yarn
[b]Count—based upon 15 random samples of each lot; 120 yards of a sample wound off on to a 54" circumference warp reel and weighed on a Knowles yarn count balance
[c]TF—calculated by use of formula $\frac{TPI}{\sqrt{Meancount}}$
[d]Strength—based upon 100 samples of each lot; Scott I P 2 seriograph yarn-strength tester, one kg wt—constant rate of load
All testing done in a conditioned atmosphere of 70° ±2F and 65±3%RH where specimen yarns were allowed to condition for 24 hours prior to testing

EXPERIMENTAL

Good-quality 1¼"-staple El Paso, Texas cotton fibers from the same bale were used for the single-ply yarns of 24's count. Spinning was done with five different twist factors in order to obtain an adequate supply of the variable to be studied: namely, yarns with twists per inch ranging from low to high. Samples from each of the five yarn specimens were examined and tested for tpi, count and strength and the twist factor calculated. The results are reported in Table I.

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[1]Dr Meske is now head and professor, Department of Clothing and Textiles, School of Home Economics, Purdue University, Lafayette, Ind.

The data presented in Table I indicate that there is a range in twist factors of more than 4 and of tpi of more than 17 from sample 1 through sample 5. The range in strength follows the known principle: cotton yarn strength will increase with an increase in twist until an optimum level is reached; this will be followed by a decrease in strength with additional twist. (Table I, Yarns 1, 4, and 7).

It will be noted by reference to Table I that yarn #1 with the lowest twist and yarn #5 with the highest twist, when judged from both the practical and the statistical viewpoints, are equal in strength; but are considerably weaker than #4 yarn, which represents the optimum level of strength due to twist. The significance of the differences in strength among pairs of the five yarn specimens can be noted in Table II.

Statistical computations support the principle that low and high twist have a similar effect upon yarn strength. Note pair #1 in Table II. However, with the first increase in twist, a significant difference becomes apparent in the t value obtained for pair #2. It will be observed that the yarn with optimum strength (TF 4.88 and TPI 23.32) is significantly stronger than two yarns with lower twist and the one yarn with higher twist (Table II, pairs 4, 6, and 8). As the optimum level of strength approaches, the difference in strength between two yarns appears to be less pronounced. This is suggested in Table II where it will be noted that yarns in pair #7 are practically equal in strength; and although noticeably different in TF and variability, show a t value below the 1% level.

A plan for weaving test fabrics was developed based upon the data presented in Tables I and II. It was decided that, of the five specimens spun for the present experimental study, yarn #4, Table I, might be considered the most typically representative; in fact, the "best-quality" yarn appropriate for weaving fabrics with various warp and filling setts. Therefore, with yarn twist as the variable in each instance, seven fabric specimens were woven according to the following specifications:

Loom used: Northrop HST
Two-harness plain weave
Speed: 205 picks per minute

Warp: 78 ends per inch
32" cc and TF 3.50
Reed width: 39 inches

TABLE II
Differences in strength of pairs of five yarns

Pair	Twist factor of samples compared	Mean strength (gm wt)	SD (gm wt)	t	Level of significance
1	3.11	368	49.91	0.44	insignificant
	7.17	365	48.44		
2	3.11	368	49.91	5.14	beyond 1%
	3.40	405	56.00		
3	3.11	368	49.91	7.16	beyond 1%
	4.24	426	65.70		
4	3.11	368	49.91	7.66	beyond 1%
	4.88	430	47.58		
5	3.40	405	56.00	2.50	beyond 2%
	4.24	426	65.70		
6	3.40	405	56.00	3.57	beyond 1%
	4.88	430	47.58		
7	4.24	426	65.70	0.51	insignificant
	4.88	430	47.58		
8	4.88	430	47.58	9.84	beyond 1%
	7.17	365	48.44		

Filling: Seven combinations

Twist factor		Pick wheel setting
1	4.88	80
2	4.88	70
3	4.88	58
4	3.11	70
5	3.40	70
6	4.24	70
7	7.17	70

Quantity woven:
Six yards of each combination of yarn and pick wheel setting

The test fabric, in one continuous length, was subjected to the following normal finishing processes:

1) *De-sized:* Nervanaise 10 x (a pancreatic enzyme)
Temperature: 70°C
Time: 30 minutes
Hot and cold wash*
2) *Scoured:* At the boil for two to three hours
Caustic soda—10.0 g/l
Metha silicate—2.0 g/l
3) *Bleached:* At room temperature —approximately one hour
Sodium hypochlorite —5.0 cc/l
Soda ash—2.0 g/l
Washed to neutralize with sodium hydrosulfide—1.0 g/l
4) Mangled through cold water
5) Cam dried

One half of the normal-finished fabric was retained for testing and one half subjected to a resin treatment as follows:

Bath formulation
7500 g ethylene urea-formaldehyde resin diluted to approximately 40 liters with cold water.
1250 g of a commercial wetting agent and softener pasted slowly and carefully with approximately three liters of water at 70°C and added through a sieve
25 cc acetic acid, 40%, added just before use, and
1000 g magnesium chloride crystals dissolved and added.
The entire solution was then diluted to 50 liters.

*Done also between 1 and 2; 2 and 3; 3 and 4, above.

Processing Method
Fabric padded at room temperature, two nips, two dips, to a liquor retention of 80%. Dried at 80°C. Cured for five minutes at 150°C. Washed off in
0.5 g soap
1.0 g soda ash
0.5 g Calgon T
for 10 minutes at 60°C shortly after curing. Rinsed three times in hot water and once in cold water.
Mangled through cold water.
Cam dried.

TEST PROCEDURES

The same tests were carried out on the normal-finished fabric and on that resin-treated and the two sets of data obtained served as the basis for the present report.

SETTS —— Warp yarns were counted in 10 one-inch areas selected at random throughout the length of each fabric specimen. Similarly, 10 additional areas, randomly selected, were examined to obtain a count of the number of filling yarns per inch. The mean values obtained from 10 recordings of warp yarns per inch and 10 recording of filling yarns per inch were accepted as representative of the setts of each fabric specimen.

CRIMP——The Shirley crimp tester was used for measurement of yarn extension. A constant degree of tension, 20 grams, was applied to both the warp and the filling yarns. This same tension was maintained throughout the tests of yarns from the resin-treated specimens. A five-inch length of yarn was used for each test. The recorded percentage of crimp is the mean value obtained from 10 tests. (Test Method A, Textile Institute Specification No. 29, 1955).

STIFFNESS —— The Shirley stiffness tester, Serial No. 31, was used to determine the bending length of fabric samples. Five warp strips and five filling strips were cut from areas distributed throughout the fabric specimens. Four readings were taken from each strip; two from each end to obtain readings from both the face and the back of the fabric. The reported mean value is based upon 20 readings of bending length in centimeters. (Shirley Institute Test Leaflet DF 1A, January 1957).

THICKNESS —— The thickness tester, manufactured by Reynolds and Branson Ltd, Leeds, England, was used. A pressure of 5.0 g/cm^2 was applied to the fabric strips previously used for the stiffness tests. Ten recordings were taken for each fabric specimen.

TABLE III
Fabric details

	Filling yarns			Setts				Crimp				Stiffness				Weight	
	Count	TPI	$T\sqrt{F}/c$	Threads per inch				Percentage				Centimeters				oz per sq yd	
Units	cc	Turns/inch		10				10				20				5	
No. of tests	15	135		Normal		Resin		Normal		Resin		Normal		Resin		Normal	Resin
Finish				Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling		
	1/24.8s	15.5	3.11	92.3	65.9	90.4	66.7	4.0	16.0	5.1	12.6	2.4	2.0	1.9	1.6	3.94	4.06
	1/24.1s	16.7	3.40	92.1	65.8	89.8	67.2	4.8	16.0	5.8	12.5	2.4	1.9	1.9	1.7	3.97	4.13
	1/23.9s	20.7	4.24	90.6	66.2	88.0	65.9	6.6	15.0	6.5	11.0	2.3	2.0	1.9	1.7	4.04	4.05
	1/23.0s	23.3	4.88	89.3	64.8	87.0	65.3	7.6	13.9	7.3	10.2	2.3	2.2	1.9	1.7	3.97	4.08
	1/21.0s	32.8	7.17	88.7	66.0	85.9	65.6	11.0	11.4	11.5	7.0	2.1	2.2	1.7	1.8	4.28	4.17
	1/23.0s	23.3	4.88	89.8	78.8	88.0	78.6	7.3	15.0	8.0	12.3	2.3	2.4	1.8	1.9	4.45	4.55
	1/23.0s	23.3	4.88	89.3	54.8	86.6	55.5	6.0	12.8	6.2	8.9	2.3	1.9	1.8	1.6	3.62	3.79

WEIGHT PER UNIT AREA——Five 100-sq-cm samples of each fabric specimen were weighed. Samples were cut from randomly selected areas throughout each fabric specimen. Weighing was done on the Oertling Releas-o-matic balance and the gram weight recorded to the nearest 0.001. Conversion of the mean values of grams per square meter were converted into ounces per square yard by use of the conversion factor 33.9064.

TEAR STRENGTH——The Elmendorf Tearing Tester was used. (Tester No. 1652, Tappi Specification T-414m-49, Serial No. 58147—H E Messmer Ltd). Testing was done according to Tentative Method of Test for Tear Resistance of Woven Fabrics by Falling—Pendulum. (Elmendorf Apparatus, ASTM Designation: D 1424—56T) (3).

As for all tests, the template used for preparation of samples was placed at randomly selected areas throughout the fabric specimens and 10 warp and 10 filling samples were cut with precise accuracy. The recorded mean values are based upon 10 tests and represent conversion of Elmendorf units to gram-weight by use of the conversion factor 32 in accordance with ASTM test specifications.

CREASE RECOVERY —— The Shirley combined stiffness and creasing tester was used. 10 warp specimens and 10 filling specimens were cut; each 2" × 1". These were flat and wrinkle free. Testing for crease recovery followed the procedures used at the Shirley Institute and reported in Methods of Test for Textiles, BS Handbook No. 11, 1956, pp 179-180 (1). Each specimen was folded in half and given a 1" crease. It was then placed between two glass plates and a 2-kg weight placed on top and allowed to remain for one minute. The weight was then removed and the sample lifted with forceps and placed between the jaws of the instrument and allowed to hang free for the duration of time necessary to equal one minute after removal from a weighted creased position. The dial of the instrument was rotated and a reading taken immediately after one minute had elapsed.

RESIN UPTAKE —— Tentative Textile Standard No. 41, 1956 was followed (4). The reported percentage uptake is based upon the difference between the weight of the two dried samples. Loss in weight due to stripping is expressed as a percentage of the weight of the dried sample before stripping.

RESULTS——A compilation of all test data appears in Table III. It will be noted that information about yarns, previously reported in Tables I and II, is again summarized and presented. This was done with the intent that Table III serve as a composite reference chart for the discussion which follows. Information about fabric specimens is presented in test categories with the number of tests done in each, the mean value of results, (SD where relevant to the type of test) units of measurement, and the yarn direction of the samples tested.

DISCUSSION

SETTS——Observation of the warp and filling setts for normal-finished fabrics reveals no striking differences among these woven with filling yarns of different twist factors. However, an element of consistency appears when one considers the pick-wheel settings used for weaving the fabrics. Those woven with pws of 70 tend to vary only two picks per inch regardless of the amount of twist in the filling yarns. The corresponding warp yarns vary four ends per inch with a decrease in ends per inch as filling yarns increase in twist. This same trend is noted for warp yarns in the fabrics after resin treatment where the total number of ends per inch for each fabric decreases from that observed prior to resin treatment. The overall data on setts of resin-treated fabrics show that, in general, there is a slight decrease in warp setts and a corresponding slight increase in filling setts over that of the untreated specimens. This tends to suggest that some extending of the fabric widthwise may have occurred during the resin impregnation and finishing processes.

TABLE IV

Yarn twist factors	Major diameter, a	Minor diameter, b	Flattening coefficient $c=\sqrt{b/a}$
3.11	244	124	0.71
3.40	242	128	0.73
4.24	238	140	0.76
4.88	222	142	0.80
7.17	233	169	0.85

CRIMP——It is apparent from data in Table III that the crimp of the warp yarns increases with the increase in twist of the filling yarns. The filling yarns were measured by means of the Bocking Yarn Geometer through the courtesy of J B Hamilton (Courtaulds Ltd) and the information shown in Table IV made available. The steady increase in yarn flattening coefficient (from 0.71 to 0.85) follows the increase in twist. It can be seen that, with an increase in twist of the filling yarns, flattening is inhibited, which causes the crimp in the warp yarns to increase.

STIFFNESS, WEIGHT AND THICKNESS —— The recorded measurements of these three properties show no conspicuous indications or trends which follow increases in yarn twist. That there were changes in these properties for the fabrics over the range of experimental yarns is evident. Also, that changes occurred due to resin treatment is evident. A summary of the extent of these changes in stiffness, weight, and thickness following resin treatment is summarized in Table V based upon data presented in Table III.

Thickness		Tear Strength								Crease Recovery								Resin uptake
Millimeters 10		gram — weight 10								degrees 10								
		Normal				Resin				Normal				Resin				
Normal	Resin	Warp	SD	Filling	SD	Warp	SD	Filling	SD	Warp	SD	Filling	SD	Warp	SD	Filling	SD	percent
0.34	0.34	1347	218	1830	285	547	42	566	61	58.0	3.2	58.3	4.4	115	5.9	115	4.9	7.7
0.25	0.32	1347	275	1840	106	515	29	534	38	57.8	4.2	56.5	5.5	118	5.4	115	3.7	9.0
0.27	0.32	1168	160	1981	144	486	22	627	77	55.3	3.7	53.3	1.5	119	5.4	111	4.7	6.6
0.26	0.30	1088	35	1869	150	592	74	714	93	59.3	1.6	50.4	2.3	121	5.5	120	4.5	6.6
0.34	0.34	1117	73	1904	131	515	61	749	48	58.9	2.9	56.4	5.4	116	6.9	100	5.0	4.5
0.34	0.32	934	35	1789	112	480	42	672	26	55.2	4.6	54.5	4.3	115	3.9	112	3.6	7.0
0.25	0.32	1190	118	2288	128	544	29	666	22	57.8	5.3	54.4	5.6	120	3.6	116	4.1	7.4

TABLE V

Stiffness, weight and thickness of fabrics before and after resin treatment

	T F of filling yarns	% resin uptake	Decrease in stiffness Warp	Decrease in stiffness Filling	Change in wt per unit area	Change in fabric thickness
	3.11	7.7	0.05	0.04	+0.12	0
	3.40	9.0	0.05	0.02	+0.16	+0.07
	4.24	6.6	0.04	0.03	+0.01	+0.05
	4.88	6.6	0.04	0.05	+0.11	+0.04
	7.17	4.5	0.04	0.04	−0.11	0
High sett	4.88	7.0	0.05	0.05	+0.10	−0.02
Low sett	4.88	7.4	0.05	0.03	+0.17	+0.07

TABLE VI

	Twist factors of yarns	Percentage loss in tear strength warp	filling
	3.11	59	69
	3.40	62	71
	4.24	59	68
	4.88	45	62
	7.17	54	61
High Sett	4.88	48	62
Low Sett	4.88	54	71

TEAR STRENGTH——With an increase in filling yarn twist there was a consistent decrease in the warp tear strength of the normal-finished fabrics. Note in particular that the fabric of highest filling sett had the lowest warp tear strength. The filling tear strength of normal-finished fabrics differed slightly with the highest recordings associated with those of the higher twist yarns. This is particularly true of the fabric with lowest filling sett, which exhibited the highest tear strength, 2288 gram-weight. However, it cannot be inferred, from the observed trend and comparative test results which reveal an optimum-strength yarn, that the use of it for weaving will produce a fabric of optimum strength. Observe in Table III the mean filling tear strength of fabrics with yarns of TF 4.88 in a higher sett and also with the lower sett. It will be noted that the mean gram-weight values are 1789 and 2288 respectively. Obviously, the looser weave permitted more yarn slippage, which resulted in increased resistance to tearing.

All fabrics suffered a high loss in tear strength due to resin treatment. Increasing the filling yarn twist appeared to afford some survival advantages. The percentage loss in fabric tear strength is presented in Table VI followed by graphic portrayal of fabric tear strength before and after resin treatment. (Figure 1).

TABLE VII

Twist factors	Mean	Σn^2	$(\Sigma n)^2$	Sigma	t	Level of significance
			WARP SAMPLES			
4.88	18.45	3461.25	34040.25	2.037	1.48	insignificant
3.11	17.10	2941.50	29241.00			
4.88	18.45	3461.25	34040.25	1.911	2.75	beyond 0.02
3.40	16.10	2600.50	25921.00			
4.88	18.45	3461.25	34040.25	1.860	3.96	beyond 0.001
4.24	15.20	2300.25	22952.25			
4.88	18.45	3461.25	34040.25	1.884	2.08	below 0.05
4.88 low sett	16.70	2795.50	27889.00			
			FILLING SAMPLES			
4.88	22.30	5044.50	49729.00	2.433	4.27	beyond 0.001
3.11	17.65	3150.25	31152.25			
4.88	22.30	5044.50	49729.00	2.190	5.75	beyond 0.001
3.40	16.65	2787.25	27722.25			
4.88	22.30	5044.50	49729.00	2.655	2.28	beyond 0.05
4.24	19.60	3877.25	38220.25			
4.88	22.30	5044.50	49729.00	2.060	1.68	insignificant
4.88 low sett	20.75	4310.75	43056.25			

Elmendorf units used in computations
18 degrees of freedom for t tests
t values at levels of significance

2.10 at	0.05
2.55	0.02
2.88	0.01
3.92	0.001

The significance of the differences in tear strength of resin-treated fabrics appears in Table VII.

CREASE RECOVERY —— Crease-recovery angles of the normal-finished fabrics were very similar; only a slight range is apparent (50.4 to 58.3°). Following resin treatment there was a marked improvement in the crease-recovery angle of all fabrics; and, the fabric constructed with the optimum strength filling yarn appears to be superior. Additional results reported in Table III show that the three lowest crease-recovery angles were those observed when: filling yarn twist was increased to 7.17, was decreased to 4.24, and when the filling yarn twist was 4.88 (optimum single thread strength) but the fabric filling sett increased. The following selected data from Table III illustrate this point:

Twist factor of yarns	Angles of crease recovery in degrees
4.24	111.4
4.17	100.2
4.88	120.0
with higher filling sett	
4.88	112.0

The percentage gain in crease recovery for all fabrics is presented in Table VIII followed by graphic portrayal of crease recovery before and after resin treatment (Figure 2) and t test results to indicate the significance of the increased crease recovery between pairs of resin-treated fabrics. (Table IX).

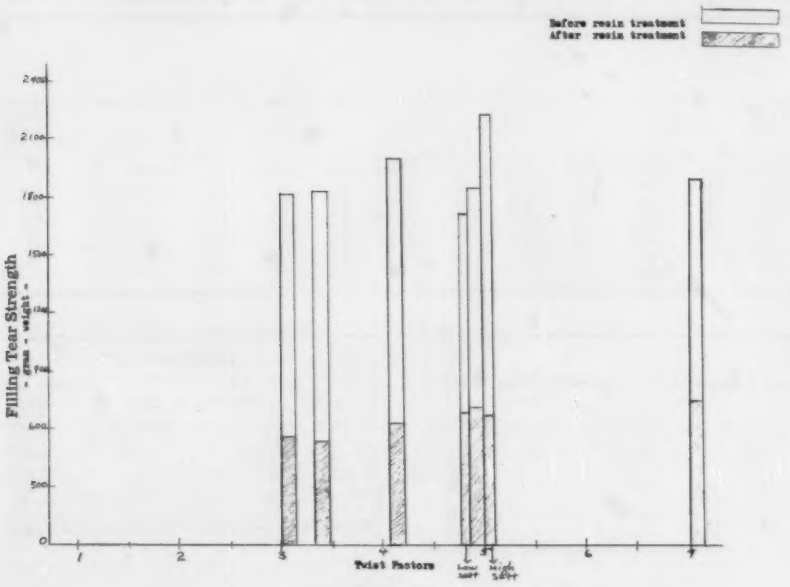

Figure 1

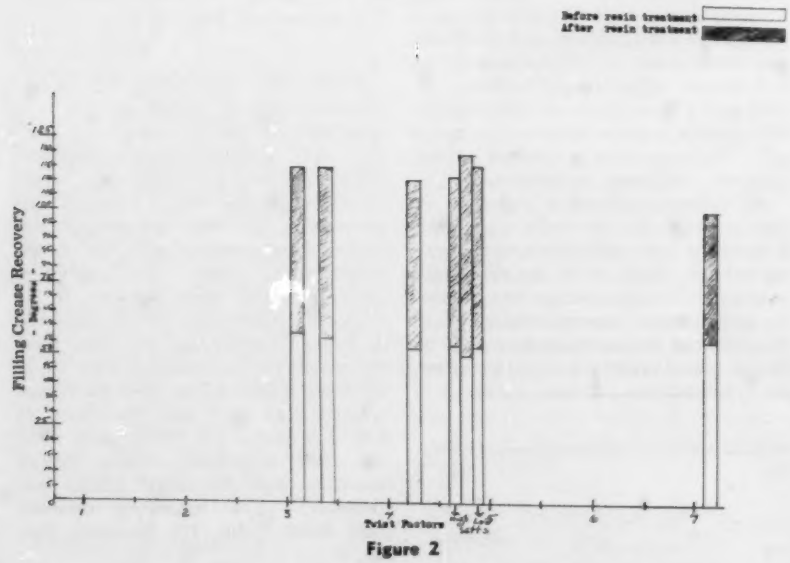

Figure 2

Overall test results with respect to both tear strength and crease recovery tend to favor those fabrics with the highest filling yarn twist. The lowest percentage loss in tear strength was observed for fabrics with TF 7.17 and TF 4.88 and the latter also exhibited the highest percentage gain in crease recovery. A decided increase in twist contributed to a considerable drop in angle of crease recovery as indicated for fabric with TF 7.17. A slight decrease in filling yarn twist also led to a lower crease-recovery angle compared with that observed for fabric of TF 4.88. The significance of the difference between tear strength and crease recovery for fabrics of TF 4.88 and TF 4.24 will be noted in Tables VII and IX. It will be seen from the value of t in Table VII that the tear strength of these two fabrics is significantly different at the 0.05 level and the advantage rests with that fabric with the higher-twist filling yarns (TF 4.88). The significance of the difference in crease recovery between these two fabrics again rests with that of higher-twist filling yarns (Table IX, t value 3.73 and beyond 0.001 level). That the

TABLE VIII

	Twist factors of yarns	Percentage gain in crease recovery warp	filling
	3.11	50	49
	3.40	51	51
	4.24	53	52
	4.88	51	58
	7.17	49	43
High sett	4.88	52	51
Low sett	4.88	52	53

difference in crease recovery would be equally or more significant between fabrics of TF 4.88 and TF 7.17 was assumed to be highly probable from data presented in composite Table III and hence no t test computations were made to verify same. (Table III—TF 4.88, Mean 120, SD 4.5; TF 7.17, Mean 100, SD 5.0).

Further observations of Table VII will show that fabric of filling twist factor 4.88 was also significantly different in tear strength from the two fabrics of considerably less twist (TF 3.11 and TF 3.40). However, the significance of the differences among these three fabrics was less pronounced with respect to crease recovery but still in favor of the fabric with the optimum strength filling yarn. Table IX shows a significant difference beyond the 5% level when the fabric with TF 4.88 is compared with that with the least twist TF 3.11. However, the performance of the optimum strength yarn when used in a fabric of higher filling sett was not as satisfactory. Note the last comparison of fabric specimens presented in Table IX.

A graphical portrayal of both tear strength and crease recovery of the seven test fabrics appears in Figure 3. Figure 4 shows the relationship of resin uptake to filling yarn twist; in Figure 5, this relationship is expressed in terms of the gain in fabric crease recovery, and in Figure 6 in terms of the loss in filling tear strength.

The relative merits of the seven fabrics, judged on the basis of both tear strength and crease recovery, tend to favor those with considerable twist. But, since any fabric put into production must also be generally acceptable to those who handle it and an economic reality as well, ten textile technologists were asked to rank the seven fabrics on two properties: 1) appearance and 2) handle. The responses were very consistent, with the following summarized results corresponding to twist factor fabric identities:

3.11 All 10 judges gave this fabric first place on appearance.

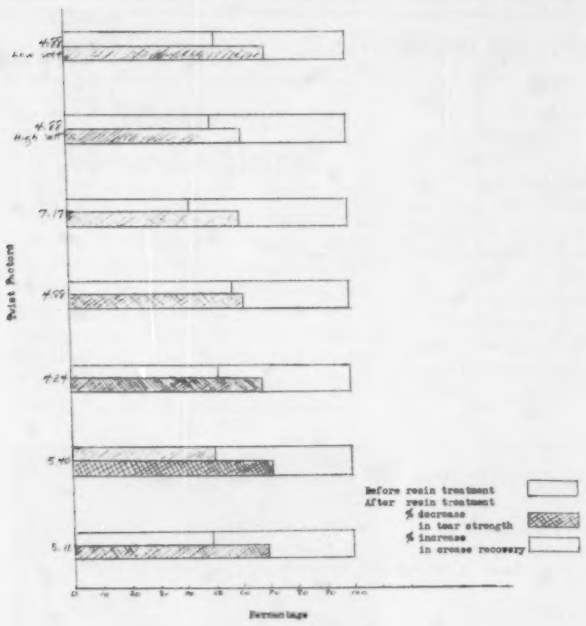

Figure 3

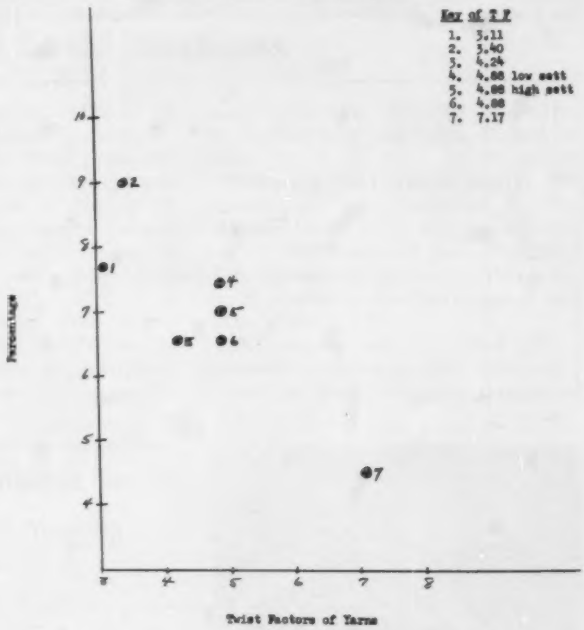

Figure 4

Five or more ratings of the other six fabrics disclosed the following decreasing order of desirable appearance:

3.40
4.88 with high sett
4.24
4.88
7.17
4.88 with low sett.

The handle ratings were a bit more scattered and no fabric received unanimous agreement. However, the fabric with twist factor 3.11 placed first with six judges in agreement. The placement of the other six fabrics was as follows:

3.40
4.24
4.88
4.88 with high sett.

Rank placement for 7.17 and 4.88 with low sett was evenly divided between sixth and seventh place, and hence, according to the judges, equally undesirable in handle characteristics. (No ranking of normal-finished fabrics was recorded. From experiecnes during testing it was believed that reactions of the judges would have followed the same trend as that recorded for the resin-finished fabrics).

SUMMARY AND CONCLUSION

Cotton yarns of 24° were spun with five different amounts of twist and each lot used for the filling in a six-yard length of fabric woven for test purposes. Warp yarns of 32° were used throughout and the pws maintained at 70. The yarn with optimum single-thread strength and least variability was used for two additional test fabrics: one woven with pws at 80 and one at 58. All fabric specimens were given a normal finish and one half submitted for resin impregnation. Both the normal-finished fabric and that given the additional resin finish were examined for setts and subjected to a series of physical tests: crimp, weight, thickness, tear strength, and crease recovery. Handle and appearance of the resin-treated specimens were ranked by 10 students of textile technology.

The strength of the yarns increased consistently with twist and decreased after the optimum strength due to twist had been attained. The optimum strength yarn also had the least variability. The yarn count decreased with twist and this was apparent in fabric setts. The warp setts decreased following resin treatment. The effect of twist upon the crimp of

TABLE IX
Significance of differences in crease recovery of resin-finished fabrics

Twist factors	*Mean*	s^2	$(s)^2$	*Sigma*	*t*	*Level of significance*
		WARP SAMPLES				
4.88	120.75	146104.25	1458056.25	10.31	1.21	insignificant
3.11	115.15	132947.75	1313316.00			
4.88	120.75	146104.25	1458056.25	5.75	0.99	insignificant
3.40	118.20	140008.50	1397124.00			
4.88	120.75	146104.25	1458056.25	5.71	0.72	insignificant
4.24	118.90	141659.50	1413721.00			
4.88	120.75	146104.25	1458056.25	4.86	2.28	beyond 0.05
4.88 low sett	115.75	143647.50	1435204.00			
4.88	120.75	146104.25	1458056.25	5.01	2.68	beyond 0.02
4.88 high sett	115.00	132632.50	1324801.00			
		FILLING SAMPLES				
4.88	120	143127.25	142922.03	4.98	2.24	beyond 0.05
3.11	115	131572.00	1313316.00			
4.88	120	143127.25	142922.03	4.60	2.01	insignificant
3.40	115	133308.50	133171.60			
4.88	120	143127.25	142922.03	4.86	3.73	beyond 0.001
4.24	111	124320.00	1240996.00			
4.88	120	143127.25	142922.02	4.55	1.87	insignificant
4.88 low sett	116	134148.25	133980.63			
4.88	120	143127.25	142922.02	4.30	4.16	beyond 0.001
4.88 high sett	112	124673.50	1245456.00			

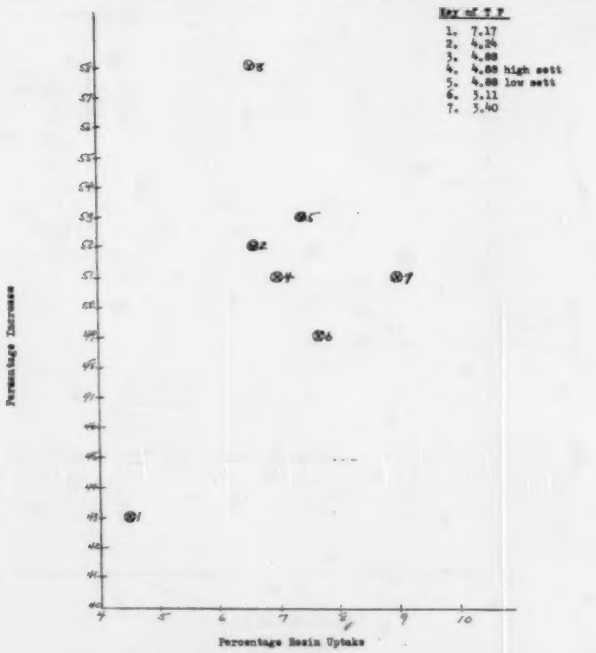

Figure 5
Gain in filling crease recovery of resin-finished fabrics

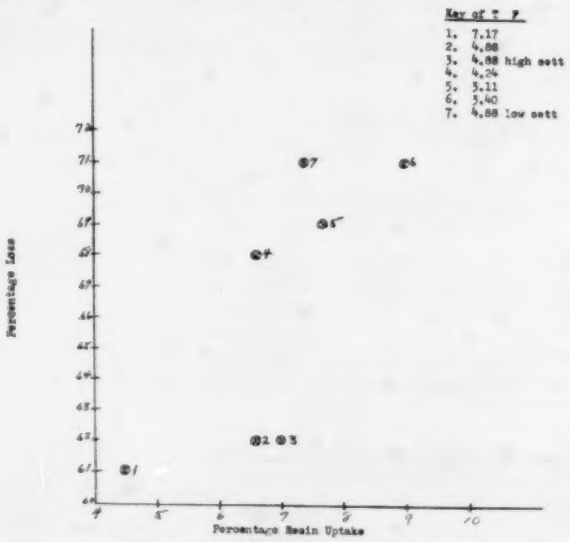

Figure 6
Loss in filling tear strength of resin-treated fabrics

warp and filling yarns followed a consistent relationship. There was a decrease in fabric stiffness following resin treatment, slight variations in weight, and slight increases in thickness of those fabrics with filling yarns of highest twist. All fabrics decreased considerably in tear strength and increased in crease recovery following resin treatment. Fabrics with highest-twist filling yarns appeared to be somewhat superior structurally to withstand the rigors of the Elmendorf tear tester. The highest crease-recovery value for resin-finished specimens was associated with that constructed of the optimum-strength filling yarn of TF 4.88 in the average pws of 70. However, the tear-strength and crease-recovery advantages in favor of the high-twist yarns were not supported by the appearance and handle ratings. Here the advantages were consistently in favor of the fabric with low-twist filling yarns. Perhaps a next step might be to explore the possibilities of the most suitable setts for such a yarn; setts which would result in a fabric with acceptable appearance and handle and at the same time adequate tear strength and crease recovery. The experimental ventures of the present study tend to confirm what is admittedly true; namely, that fabric geometry is basically important in the production of cotton fabrics destined for resin treatment and ultimate consumer satisfaction. It follows, then, that increased attention might well be given to determining the "best" yarn and the "best" setts for cotton fabrics subjected to resin finishing and destined for a specific end use.

ACKNOWLEDGMENT

The author expresses appreciation to the personnel of the Manchester College of Science and Technology, Courtaulds Ltd, and Ciba Clayton for supplies and materials and for the opportunity to discuss the scope of the project. She is deeply grateful to the staff of the textile industries department of the Manchester College of Science and Technology, where the experimental work was done, for the privilege of using laboratory space, equipment and facilities. Special thanks are due the following individuals:

Professor J J Vincent, head of the department, for the administrative negotiations which made it possible to carry out this study in a three-month period.

G E Cusick, lecturer in textile technology, for helpful discussions of the experimental design and of the laboratory tests.

L Morris of the textile chemistry department for use of equipment, facilities, and staff necessary to process the fabric finishes.

TEST REFERENCES

(1) Methods of Test for Textiles
BS Handbook No. 11, 1956,
British Standards Institution,
British Standards House, 2 Park St,
London W1, England

(2) Shirley Institute Test Leaflet No. AC 6,
Second Edition, March 1956

(3) ASTM Standards on Textile Materials,
ASTM Committee D-13 on Textile Materials,
November 1958,
American Society for Testing Materials,
1916 Race St, Philadelphia 3, Pa
pp 573-577

(4) Journal of the Textile Institute,
Vol 47, No. 12, Dec 1956,
p 1029-1030

TEARSHEETS AVAILABLE

Tear sheets of articles which have appeared in AMERICAN DYESTUFF REPORTER since July, 1956 are available in limited quantities. (Consult yearly indexes for list of titles). These may be obtained by sending a stamped, self-addressed envelope along with a request for the specific articles. Write TEAR SHEETS, American Dyestuff Reporter, 44 East 23rd St, New York 10, NY.

Activities of the Local Sections

Western New England

WESTERN NEW ENGLAND SECTION held its annual Ladies Night Meeting on Friday evening, May 19, at Rapp's Paradise Inn, Ansonia, Conn, with all officers present. Eighty attended.

Chairman Albert H Rant, Laurel Soap Mfg Co, Inc, introduced George O Linberg, Melrose Chemical Corp, who again acted as toastmaster.

Mr Linberg introduced Lynn E Egy, a student at Lowell Technological Institute, and Mr Rant presented Mr Egy a certificate indicating that he was the recipient of the WNE Section's scholarship award, which the Section received as a result of its efforts in last year's Individual Membership Drive.

Toastmaster Linberg then introuced George P Paine, AATCC's executive secretary, who congratulated Mr Egy and the Section and read a letter indicating that the check for the scholarship was being mailed to LTI.

Following the business session, entertainment was furnished by the Shelton Chapter of the Society for the Preservation and Encouragement of Barber Shop Quartets. This once again proved to be very popular entertainment.

The evening was concluded with a program of dancing, with music furnished by Rapp's Paradise Orchestra.

Western New England Section
Ladies Night Meeting
•
May 19, 1961
•
Rapp's Paradise Inn
Ansonia, Conn

Metropolitan

"THE Wonderful World of Mary Doe" was the subject of a talk by Willie Mae Rogers, director of Good Housekeeping Institute, at the annual Ladies Night meeting of the Metropolitan Section, AATCC, held Friday evening, May 19 at Kohler's Swiss Chalet, Rochelle Park, NJ.

In her presentation, Miss Rogers discussed many new things that are happening or are about to happen in the world of women and homemaking, and the story of Good Housekeeping Institute and its relation not only to the homemaker and her world but also to the industries involved in that world.

Metropoltian Section
Ladies Night Meeting

•

May 19, 1961

•

Kohler's Swiss Chalet
Rochelle Park, NJ

Willie Mae Rogers, director, Good Housekeeping Institute, discussing "The Wonderful World of Mary Doe" at Metropolitan Section's Ladies Night meeting on May 19

Willie Mae Rogers, director, Good Housekeeping Institute, addressing Metropolitan Section Ladies Night audience. At right is George S Wham, Phillips-Van Heusen Corp, who introduced Miss Rogers

Mrs P J Kennedy; P J Kennedy, E I duPont de Nemours & Co, Inc; W D Hart, Fairchild Publications; James W Monks, Poughkeepsie Dyestuff Corp

Mrs H Casparian; Mrs S Ohanian; Haig Casparian, Craft Textile Printing Co, Inc; Sourene Ohanian, Craft Textile Printing Co, Inc

Ralph A Duchacek, Interchemical Corp; Mrs R A Duchacek; W Carricioli; Mrs O Poltersdorf; Mrs W Carricioli; Otto Poltersdorf, Interchemical Corp

Mrs G S Wham; George S Wham Phillips-Van Heusen, chairman, Technical Committee on Research; Mrs F Leger; Frank Leger, Good Housekeeping Institute; Willie Mae Rogers, Good Housekeeping Institute, guest speaker; Elizabeth Ramsey, Good Housekeeping Institute; P J Fynn, J C Penney Co, Metropolitan Section chairman; Mrs P J Fynn

William E Mainella, National Aniline Div, Allied Chemical Corp; Thomas Johnson, Allied Chemical Corp; Mrs T Johnson; Mrs W E Mainella; Mrs W F Ferraxano; William F Ferraxano, National Aniline Div, Allied Chemical Corp; Mrs S Homer; Steven Homer, Monte Christi Corp

Alvin Lubin, Atlantic Chemical Corp; Mrs A Lubin; John A Komninos, Waldrich Co; Mrs J A Komninos; N M Canarisi, Nopco Chemical Co; Mrs N M Canarisi

Mrs E J Grady; Mrs C E Wright; C Elmer Wright, Jacques Wolf & Co; Eugene J Grady, Jacques Wolf & Co

Albert E Johnson, National Institute of Drycleaning; Mrs A E Johnson; Myron D Reeser, Howes Publishing Co, Inc; Mrs M D Reeser; Richard E Miller, Eastman Chemical Products, Inc; Mrs R E Miller

Mrs Arthur R Wachter; George F Gaede, Morgan Dyeing & Bleaching Co; Mrs R P Monsaert; Richard P Monsaert, American Felt Co; Mrs G F Gaede; Arthur R Wachter, textile engineer and consultant

Thomas P Innes, Barlin Knitwear, Inc; Mrs T P Innes; Ernest S Kandibo, Milpac Dyeing Co, Inc; Mrs E S Kandibo; Richard Dormack, Milpac Dyeing Co, Inc; Mrs R Dormack; Henry A Weil, The Chemstrand Corp; Mrs H A Weil

Daniel T Koshak, Spinnerin Yarn Co, Inc; Mrs D T Koshak; Charles R Trommer, Boris Kroll Fabrics, Inc; Jack Moss, Putnam Chemical Corp; Mrs C R Trommer; Mrs S E Korpanty; Stephen E Korpanty, Boris Kroll Fabrics, Inc

James M Polito, Geigy Dyestuffs; Mrs J M Polito; Hans Werner, Nu-Method Dyeing & Processing Co; Mrs L F Mayo; Mrs H Werner; Francis J Peterson Jr, Ciba Co, Inc; Lawrence F Mayo, Cosmo Dye Works; Mrs F J Peterson Jr

Alan D Nacht, Chicopee Mfg Corp; Mrs A D Nacht; George H Hansen, Industrial Products of America; Platte B Moring Jr, Eastman Chemical Products, Inc; Mrs G H Hansen; Mrs P B Moring Jr

Pacific Northwest

PACIFIC NORTHWEST SECTION held its Spring meeting at the Aero Club, Portland, Ore, on Friday, June 2nd, with approximately 29 persons in attendance.

A social hour preceded the dinner and session, which featured a talk by R G Jaffe, supervisor of color research of Crown Zellerbach Corporation, Center Research Division, who spoke on "The Use of a Spectrophotometer in Color Analysis."

The date of the Section's summer outing, to be held at Welches, Mt Hood, Ore, was established as July 29th. Richard B Loomis, United Chemical Co, will serve as outing chairman.

Membership Applications

May 25-June 7, 1961

NEW ENGLAND REGION

Western New England Section

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Rocco A Bellantoni—Asst supv, textile research lab, American Cyanamid Co, Stamford, Conn. Sponsors: J J Black, R A Dubreuil.

CENTRAL ATLANTIC REGION

Delaware Valley Section

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Martin S Maltenfort—Director, Chemical & Engineering Associates, Elkton, Md. Sponsors: L M Vickery, P E Talley.

Metropolitan Section

Transfer to Senior—Reinstate

Rudy W Malizia—Dyer, Quality Skein Dyeing Co, Paterson, NJ. Sponsors: E G Bobilin Jr, C G Germanetti.

SOUTHERN REGION

Northern Piedmont Section

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Melton S Birmingham Jr—Sales & tech rep, General Dyestuff Co, Charlotte, NC. Sponsors: C A Sledge, W G Green.

Junior

James A Connell Jr—Finisher, Wake Finishing Co, Wake Forest, NC. Sponsor: G J Mandikos.

Transfer to Senior

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Piedmont Section

Senior

James T Currier—Industrial engineer, Collins & Aikman Corp, Cavel, NC. Sponsors: G R Currier, R G Reall.

South Central Section

Associate

Jack C Rose—Tech rep, Dow Chemical Corp, Chattanooga, Tenn.

Southeastern Section

Senior

James L Knowles Jr—Dyestuff salesman, General Dyestuff Co, Charlotte, NC. Sponsors: R K Federal, W B Huntley.

Junior

Mrs Bethelehem K Andrews—Organic chemist, Cotton Finishes Lab, Southern Regional Research Lab, SURDD, USDA, New Orleans, La. Sponsors: R M Reinhardt, J G Frick Jr.

AT LARGE

Senior

Aubrey J Brown—Textile chemist, President Knitting Mills Pty Ltd, Benoni, South Transvaal, South Africa. Sponsors: J V Moore, C J McLaughlin.

Adrian J Stewart—General mgr, Probst & Cia Ltda, Medellin, Colombia. Sponsors: V Scherrer, H Schwarz.

AATCC Calendar

COUNCIL; NATIONAL COMMITTEES

Sept 26 (Statler Hotel, Buffalo, NY); Council (8 PM)
Oct 26-27 (Sheraton Hotel, Philadelphia, Pa); TCR, research and administrative committees
Nov 17 (Hotel Sherman, Chicago, Ill); Council and Annual Meeting (2 PM)
Jan 26 (Hotel Commodore, New York, NY); Council (10 AM)
Apr 12-13 (Francis Marion Hotel, Charleston, SC); Council, administrative and research committees

NATIONAL CONVENTIONS

Sept 27-29, 1961 (Hotel Statler, Buffalo, NY); 1962 (Atlanta Biltmore Hotel, Atlanta, Ga); 1963—Boston; 1964—New York; 1965 (Conrad Hilton Hotel, Chicago, Ill); 1966 (Philadelphia, Pa)

DELAWARE VALLEY SECTION

Sept 15 (Wilmington, Del); Oct 27, Dec 1 (Beck's Restaurant, Philadelphia, Pa)

MID-WEST SECTION

Nov 18 (Chicago, Ill)

NORTHERN NEW ENGLAND SECTION

Sept 8 (Annual Outing); Oct 20 (Quartermaster R & E Command, Natick, Mass); Dec 18 (Motel 128, Dedham, Mass); Jan 19 (Woodlawn Country Club, Newton, Mass)

PACIFIC NORTHWEST SECTION

July 29 (Outing—Welches, Mt Hood, Ore); Nov 10 (business meeting)

PACIFIC SOUTHWEST SECTION

Sept 30 (outing), Nov 17

PALMETTO SECTION

Sept 15-16 (Clemson House, Clemson, SC); Jan 20-21 (Poinsett Hotel, Greenville, SC); April 14-15, 1962 (Francis Marion Hotel, Charleston, SC)

PIEDMONT SECTION

Sept 23 (Hotel Barringer, Charlotte, NC); Jan 27 (Hotel Charlotte, Charlotte, NC); Apr 7 (Hotel Barringer, Charlotte, NC); June 8-9 (1962 Outing—Mayview Manor, Blowing Rock, NC); Sept 29, 1962 (Hotel Barringer, Charlotte, NC)

RHODE ISLAND SECTION

Sept 15 (Management Meeting); Oct 17 (Dinner Meeting); Dec 1 (Annual Business Meeting)

SOUTH CENTRAL SECTION

Sept (Hotel Patten—tentative)

SOUTHEASTERN SECTION

Sept 9 (Ida Cason Gardens, Pine Mountain, Ga); Nov 25 (Atlanta Athletic Club, Atlanta, Ga)

WESTERN NEW ENGLAND SECTION

Sept 15 (Plant visitation); Oct 27 (Annual Meeting) Dec 1 (Shelton, Conn)

Elected to Membership

No designation after name indicates Senior
(A) indicates Associate
(J) indicates Junior
(S) indicates Student
* indicates transfer from another class of membership.

June 15, 1961

NEW ENGLAND REGION

Northern New England Section

Eugene D Robie
Dante Vivilecchia

Western New England Section

James J Byrne

CENTRAL ATLANTIC REGION

Metropolitan Section

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Emanuel J Malfa
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Palmetto Section

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Watt McCain
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*Norman A Metivier**

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John H Martin

Southeastern Section

Trammell E Burch
John T Foley
Dean D Lewis Jr
Charles O Drummond (J)
Mary N Edmonds (J)
Larry L Martin (J)

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Johnny P Pullen (S)

AT LARGE

Andre Mandel
Alberto Turinetti
*Peter J Ambry**

AATCC – Deceased

Member	*Section*
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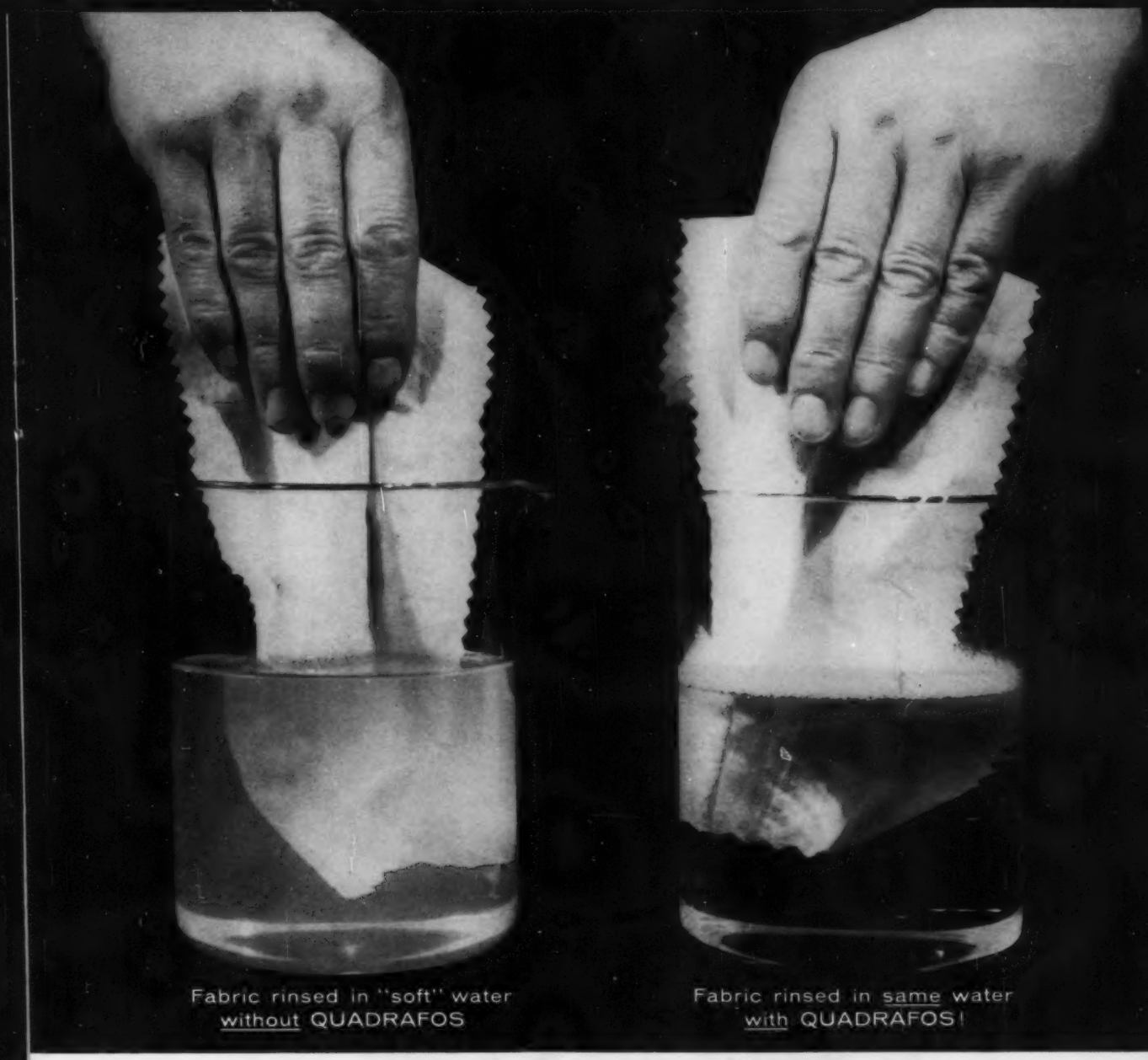

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ADR News Report:

General News of the Industry
Personalities in the News
New Products, Developments, Processes

NEW EXPANDED LABORATORY building of Gagliardi Research Corp, at 5454 Post Rd, East Greenwich, RI is shown above. The research and development efforts of GRC are primarily devoted to the synthesis and development of resins and polymers for finishes and coatings of fibrous materials.

NCC Study Sees "Easy-Care" Cotton Potential of 7 Billion Yards

Although nearly two billion yards of cotton fabrics are being processed to impart "easy-care" qualities, there is a potential for an additional five billion yards, according to a recently completed National Cotton Council study.

The Council estimates that 1.9 billion yards of "easy-care" cottons were produced in 1959, representing 63 percent of the total which includes synthetics and blends.

This production, however, is only 26 percent of the total textile market in which wrinkle-resistance and "easy-care" properties are important. The other 74 percent represents a potential market of over five billion yards of fabric and considerably more than 100 million pounds of chemicals.

The study, "Wrinkle Resistance and Recovery from Deformation," was made by Henry Tovey of the Council's utilization research division. Copies may be obtained from the National Cotton Council, 1200-18th Street, NW, Washington, DC.

Composition and structure of the cotton fiber are discussed in detail in the report. It also describes processes and materials used in improving cotton's wrinkle recovery.

Retention of smooth appearance is the only property of "easy-care" cottons that has been exploited extensively, the report explains. Further improvements, it adds, can open new markets for cotton and for chemicals needed to treat them. They can lead to products with other desirable qualities such as warmth or bulk without weight.

Despite their many advantages, "easy-care" cottons fall short of the ideal and the field offers many opportunities for rewarding research and development, Mr Tovey notes.

This resarch reportedly should include a detailed study of the cotton fiber—its structure, possibilities for breeding resiliency into it, and fundamental investigations of mechanisms by which native cotton fibers deform and recover from deformation.

Effects of various types of treatments, strength losses, creaseproofing agents, function of catalysts, pretreatment of fabrics to be finished for wrinkle resistance, yarn and fabric constructions, and testing methods are listed among other factors needing study.

Conventional wrinkle-resistant cotton fabrics shed wrinkles and maintain the flat state in which they were cured. By the same token, however, their creasability is poor and they do not hold inserted creases. This hinders their use in dress trousers and other garments.

Cotton fabrics suitable for such products are readily available, and if the problem of durable creasing could be solved, cotton could capture a substantial part of the market, it is stated. Some work has been done on this problem, but the market potential is said to warrant further effort.

•

KAE Sponsors Laud Results of Show

The sponsors of the 45th biennial Knitting Arts Exhibition have evaluated the show as "having introduced the greatest array of new scientific and technological developments ever presented by a single exposition to the world knitting trade."

William F Williamson, president, National Association of Hosiery Manufacturers; Sidney S Korzenik, executive director, National Knitted Outerwear Association; and Robert D McCabe, managing director, the Underwear Institute, said that the exhibition was highlighted by the record number of machines, equipment, fibers and specialized items which were unveiled for the first time anywhere. These new developments foreshadow a period of rapid growth for the knitting industry in the coming years, they said.

The associations added that plans are now underway to make more space available for the next KAE, which will be held April 29-May 3, 1963 in Convention Hall, Atlantic City. They characterized the volume of space requests received to date for the 1963 show as the largest number ever received at such an early date.

According to Robert T Kenworthy, the exposition manager, "More than 25 percent of the firms which participated at the 1961 KAE have thus-far returned their space application for 1963. We are therefore considering utilizing a portion of the lower floor of the Hall for the first time to accommodate the heavy demand for display booths."

The sponsoring associations, whose 1961 show attracted record numbers of 225 exhibitors and more than 16,000 viewers, expect the 1963 show to set even higher marks.

•

Baurmeister

GE Silicones Dept Opens New Sales Office in California

The Silicone Products Department of General Electric has opened a sales office in Burlingame, Calif, at 1229 Burlingame Ave. Red Baurmeister is the Company representative in the new sales office, the business telephone of which is Diamond 4-5757.

The San Francisco area, formerly serviced from Los Angeles, will now be covered by the Burlingame office.

AICC Opens New McCook Facilities

A new 30,000-square-foot laboratory and pilot plant devoted to research in chemicals made from animal and vegetable fats and oils was formally opened May 19 at McCook, Ill, by Armour Industrial Chemical Company.

Production of these chemicals reportedly involves 100,000,000 pounds of raw fats and oils a year and processing is carried out in the plant adjacent to the new laboratory. Purpose of the laboratory is to develop new products, improve manufacturing and synthetic processes, find new applications for these chemicals, and to provide technical service to customers.

The laboratory, at 8401 W 47th Street, McCook, is of modern, one-story design with a central "T"-shaped corridor connecting the 11 working laboratories, lobby, conference rooms and offices. The laboratory area comprises 26,000 square feet of working space.

Facilities have been provided for new product research, process improvement, analytical research and application work in such areas as textiles, petroleum, mineral flotation, bacteriology, asphalt and plastics. Special laboratories have been provided for constant humidity, low-temperature and high-pressure work.

Four especially constructed areas are located in a room at the east end of the building where experiments requiring pressures as high as 7,500 pounds per square inch may be conducted. Each unit is enclosed in steel plate and its top is covered by wire cable mats.

The laboratory, built in 20 by 26-foot modules to allow for flexibility, is completely air conditioned.

Connecting the laboratory and pilot plant is a service corridor off which are a technical library, store-room and offices for the pilot plant. Also close by is a completely equipped shop for building unique laboratory instruments not readily available on the market.

The pilot plant covers approximately 4,000 square feet.

It is equipped to handle pressure reactions ranging from 100 up to 5,000 pounds. It has glass-lined reactors for working with corrosive materials, autoclave capacity from two up to 300 gallons, and units for high-vacuum, high-temperature, flash, and fractional distillation.

A portable refrigeration unit makes possible control of temperatures down to zero degrees Fahrenheit for low-temperature reactions. All types of filtration equipment are provided including a rotary vacuum washing type.

The laboratory and pilot plant employ 75 people under the direction of M R McCorkle.

•

Owens-Corning Fiberglas to Hold Fall Series of Technical Symposia

Owens-Corning Fiberglas Corp has announced that it will sponsor a series of seminars during the fall months, both in New York and in other key cities throughout the country. They will be moderated by Roland K Gagnon and Edward A Morris, technical representatives from the Owens-Corning Textile Research and Development Laboratory in Ashton, RI.

The first symposium will outline the correct sewing and installation procedures for Fiberglas.

The second seminar will be concerned with the commercial laundering of Fiberglas curtains and draperies.

•

Price Reduction in Moropol 700

Moretex Chemical Products, Inc, Spartanburg, SC, has announced a price reduction in its Moropol 700 polyethylene emulsion.

The new price, effective June 15, is 20½¢ per pound in single drums and 19¢ per pound in truckloads of drums. Moropol 700 is packaged in 55-gallon non-returnable steel drums at 450 pounds net weight. All prices are on an FOB Spartanburg basis.

•

Cellofilm Industries Purchased by Polychrome

Polychrome Corp, Yonkers, NY, has announced the acquisition of Cellofilm Industries, Inc, 241 Union Avenue, Wood Ridge, NJ, as a wholly owned subsidiary.

The new company will be known as Cellofilm Corp. All present personnel will be retained; Stanley Eysmann will continue in the position of president, and William J Flynn will continue as vice president.

Cellofilm Corp, in continuous operation since 1916, is one of the nation's largest consumers and processors of nitrocellulose. The company specializes in the chemical fabrication for bulk users of nitrocellulose compounds. Full tank wagon delivery facilities are provided by Cellofilm in the East, South and Midwest.

•

New Urea-formaldehyde Concentrates

The first three of an anticipated wide range of urea-formaldehyde concentrates are now commercially available from Hercules Powder Co's newly completed facilities at Hercules, Calif.

The initial three products are designed for the economical manufacture of many types of urea-formaldehyde resins for a variety of industries on the West Coast, including the textile industry.

Sold by the Synthetics Department of Hercules, the three products are identified as UFC 7626, UFC 7147, and UFC 8545. The products differ in the content of formaldehyde and urea and solids content.

UFC 7626 is a pumpable liquid of 76 percent minimum solids content. It is said to offer maximum urea content consistent with stability during shipment and reasonable storage. The total formaldehyde content of this product is roughly 43 percent.

UFC 7147 is a clear, stable, low-viscosity liquid solution of urea in formaldehyde and water. Solids content is 71% minimum. The total formaldehyde content is around 50%. UFC 8545 is a similar product but at a higher concentration—85% minimum solids.

•

Dyasist #486

Dyasist #486, a new product offering of Arkansas Co, Inc, has been developed for use in dyeing woolen fabrics and yarns.

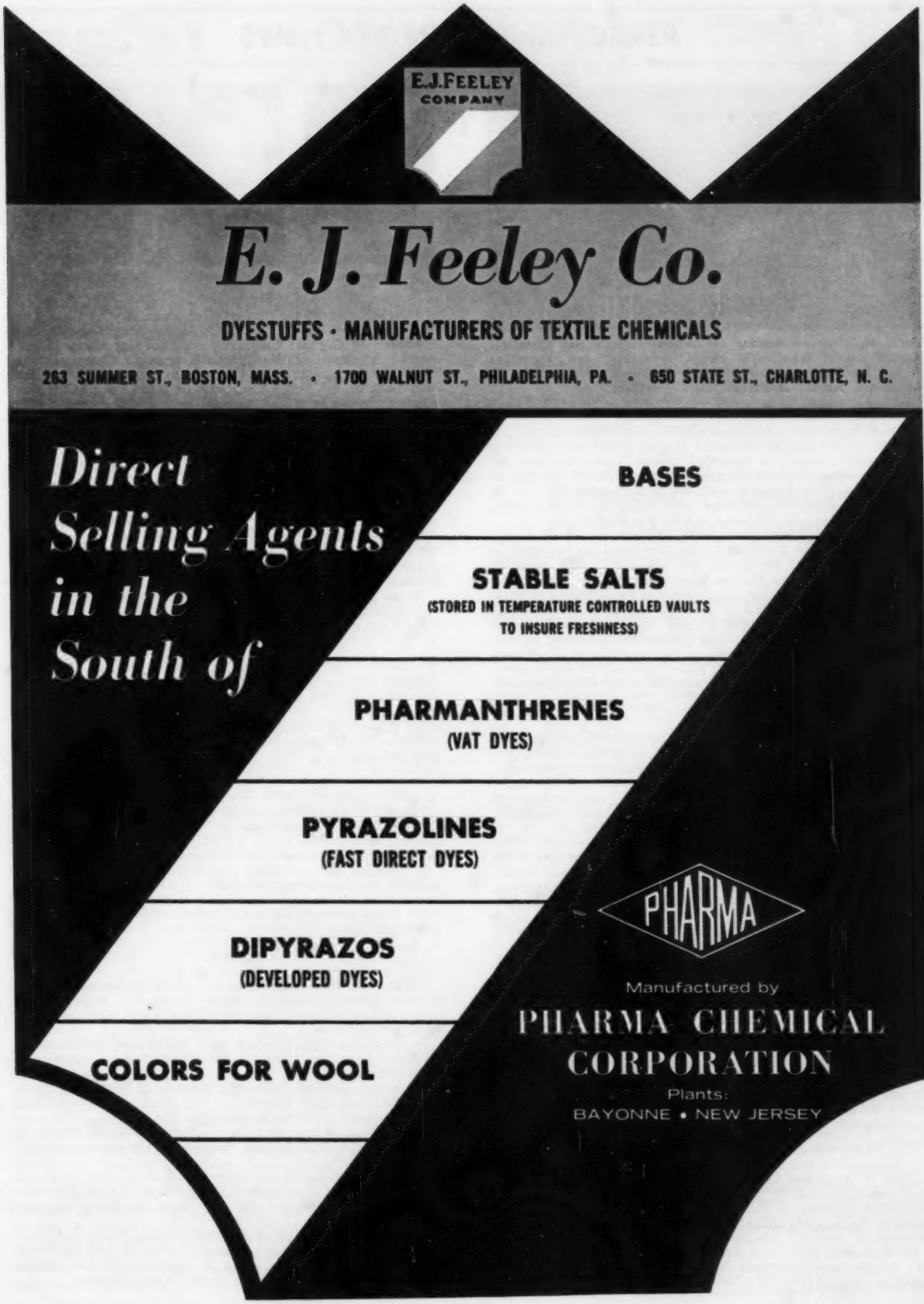
Said to be particularly applicable where acid dyes requiring sulfuric acid are used, this leveling and retarding agent allegedly produces extremely level and uniform dyeings. Reportedly good results are obtained when Dyasist #486 is used with most milling colors, and it is, in addition, recommended by the manufacturer for stripping dyed material before redyeing.

Dyasist #486 is said to be mildly cationic in nature and practically neutral in reaction. In consistency, it is an amber liquid which dissolves readily in water. The storage properties of Dyasist #486 are said to be excellent under normal atmospheric conditions.

•

Ciba Co, Inc Names New Agency

Ciba Co, Inc, Fair Lawn, NJ, has appointed Leonard and Maxwell, 280 Madison Avenue, New York, NY, to handle advertising, sales promotion, special publicity and trade relations for its three divisions, Dyes, Chemical Specialties and Pigments.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PERSONALITIES IN THE NEWS

Peter E Schwartz, winner of National Starch and Chemical Corp's annual scholarship award, receiving congratulations from Frank Greenwall (right) National's chairman of board and Donald D Pascal (left) president.

Peter E Schwartz of Scarsdale, NY, has been named the winner of the annual National Starch and Chemical Corp scholarship, which is awarded annually to the son or daughter of a National Starch employee. He is the son of *Mr & Mrs Ellis Schwartz* and the grandson of the late *A A Halden*, who was executive vice president of the company. He plans to attend Cornell University.

The selection of this scholarship is made by the National Merit Scholarship Corp under an arrangement between it and the company. Recipients are selected on the basis of the National Merit's testing program together with their high school records. The scholarship is for a period of four years and is unrestricted as to school or choice of career.

This scholarship is part of the company's widespread program of contributions to aid education. Included in this program are four-year scholarships at colleges througout the country, and direct grants made annually to the various state associations of colleges in areas in which the company's facilities are located.

●

John D Guthrie and *Robert T O'Connor* have been named acting chiefs of the Cotton Chemical Reactions Laboratory and the Cotton Physical Properties Laboratory, respectively, of the USDA's Southern Utilization Research and Development Division at New Orleans, La.

The Cotton Chemical Reactions Laboratory is concerned with exploratory research on cotton, including the use of high energy radiation to induce changes in cotton. The Cotton Physical Properties Laboratory is concerned with cotton fiber physics, microscopy, textile testing, and spectroscopy. Both laboratories were created recently to bring greater efficiency to scientific research on cotton within the Southern Division.

Dr Guthrie has long experience in cellulose chemistry and is well qualified to direct exploratory research in the chemical modification of cotton. He has conducted or directed research involving the synthesis of unusual organic compounds for use in this work and is the inventor or co-inventor of several processes for making cotton flame resistant.

Mr O'Connor has devoted his entire 20 years at the Southern Division to the application of highly specialized methods and instruments for studying both natural and chemically modified cotton and other agricultural products. He has been particularly active in the field of spectroscopy where he is known as a specialist and for which work he was honored with the Department's Distinguished Service Award.

●

Gene A Brost has been appointed to the position of product manager—intermediates, Antara Chemicals, a Division of General Aniline & Film Corp. The appointment became effective June 1. Mr Brost succeeds *Frank Card*, who has resigned to accept a position with another company.

Mr Brost has been with Antara Chemicals since May 1956, and for the past two years held the position of midwestern regional manager.

Newman

Klaeui

Powers

Melvin S Newman, professor of chemistry at Ohio State Univ, received the 1961 SOCMA Medal Award for Creative Research in Organic Chemistry on Thursday, June 15, at a special luncheon of the Synthetic Organic Chemical Manufacturers Association, sponsor of the award. The luncheon was held at the Hotel Roosevelt in New York. Carl Gerstacker, president of the Association, made the presentation.

The medal was awarded to Dr Newman for his overall research work in organic chemistry, including his outstanding contributions to the chemistry of "overcrowded" molecules culminating in the synthesis and resolution of hexahelicene, the first member of a new class of optically active polycyclic hydrocarbons. The synthesis of this group of "overcrowded" molecules not only brought into being a new kind of asymmetry, but has led other investigators in different fields to study various properties of these unusual molecules. Many of the compounds that Dr Newman has investigated and synthesized are now being used in cancer studies.

In his acceptance speech, Dr Newman, who after 24 years of teaching still modernizes his techniques regularly, discussed the problems involved in a chemical education today.

●

James Hunter, Inc, Mauldin, SC, has announced the appointment of *Hans J Klaeui* to its development engineering staff.

Mr Klaeui joins Hunter from American Rieter Co, Inc, a subsidiary of Rieter Machine Works, Ltd, Winterthur, Switzerland.

●

Donald H Powers has been named assistant director of Fabric Research Laboratories, Inc, Dedham, Mass. Dr Powers, who started his duties May 1, will head up the expanding chemical research functions of the firm.

Dr Powers was previously with Warner-Lambert Pharmaceutical Co where, for the past ten years, he was head of research and became vice president of its Research Institute. During recent years he has acted as a consultant for Arthur D Little, Inc.

●

Winner of the 1961 Polhem Award as author of the outstanding Swedish scientific paper of the year is *Joel Lindberg*, visiting research professor of textiles at North Carolina State College.

Dr Lindberg will receive a gold medal and a cash award of $3,000 from the King of Sweden at special ceremonies in Stockholm.

His paper, entitled "Scientific Aspects of Wool Fabrics as Garment Construction Materials," is the first in the field of textile technology to be selected for the award.

The Polhem Award, first presented in 1876, is named in honor of Chistopher Polhem, renowned 17th Century Swedish scientist.

Dr Linberg is on a one-year leave of absence from his position as associate director of the Swedish Textile Research Institute at Gothenberg. He will return to Sweden at the end of July.

Since joining the staff of the State College School of Textiles he has continued his research in fabric geometry and has delivered several lectures in seminars at the college and to other scientific groups in the United States.

Card

Deltombe

Jackson

McCardle

Berkshire Color & Chemical Co has announced the appointment of two new executives at the company's Reading, Pa, plant.

Frank C Card, formerly an intermediate product manager for General Aniline & Film Corp, has been made Berkshire's director of marketing. *Emile Deltombe*, formerly director of process development at Labaz (pharmaceutical division of Societe Belge de l'Azote, Belgium), will serve as Berkshire's director of research. Dr Deltombe's diversified background includes research and manufacture of dyestuffs, pigments & pharmaceuticals, and industrial chemicals.

•

New Bedford Institute of Technology Alumni Association, at its recent annual meeting, elected *Albert Malick* president for the ensuing year. During the past two years he has been vice president of the Association and chairman of the Alumni Fund. Mr Malick is president of Emkay Chemical Co, Elizabeth, NJ.

•

A total of 27 employees shared in seventeen special awards totaling $17,400 for outstanding achievements in General Aniline & Film Corporation during 1960.

The annual awards were made to the largest group yet recognized and in accordance with the Company's Executive Incentive Compensation Plan program based upon divisional management recommendations.

Eugene V Hort, senior chemist, product, research & development of the Linden, NJ, plant of The Chemical Group of the Company, was given the highest monetary award for "Development of Processes for the Manufacture of Butenediol and Butanediol." He also shared in an award for "Process Development of Toluene Diisocyanate" which was awarded to *H B Freyermuth*, research fellow, of the Central Research Laboratories, Easton, Pa, of the same group.

Of the seventeen special awards, the Company's Chemical Group obtained twelve with five going to the Photo & Repro Group. Employees of the Linden, NJ, plant of The Chemical Group were awarded seven of the twelve awards that went to The Chemical Group. Other employees of both groups shared in the various awards.

Other special awards in the Linden plant of The Chemical Group were as follows:

In the "Process Improvement of Alkyl"—*Robert F McCarthy*, production supervisor. In the "Process Improvements in Chlorine-Caustic Soda Manufacture"—*Alfred F Harter*, project engineer, and *Matthew F Lipworth*. In the "Quality Improvement and Cost Reduction of Dyestuffs"—*Winfred C Craig*, chemist leader. In the "Process Engineering Development of Toluene Diisocyanate"—*Gerard A Haefeli*, research & development supervisor; *Adolf J Pribush*, chemical engineer I; and *Marcellus C Rozzi*, chemical engineer II. In the "Improvement of the Linden Safety Program"—*Herbert W Hastrup*, supervisor, safety, fire protection & security.

Others in The Chemical Group receiving special awards were: *Nicholas J Econome*, supervisor, manufacturing cost control, Rensselaer, NY, plant for his "Contribution to the CARE Program"; *Leslie G Nunn*, senior chemist, Linden plant, and *Fred E Woodward*, assistant program manager, Easton, Pa, Central Research Laboratories, for "Process Improvements and Applications Research in Phosphate Ester Surfactants"; *William Belschwinder*, production chemist, Rensselaer plant, for "Yield and Quality Improvements in Azo Dyestuffs," and *James A May*, manager, electronic data processing, and *Vincent Trupper Jr*, supervisor, Order Service Section, both of the main offices of The Chemical Group in New York, for "Improvements in Accounting Procedures."

Two changes in sales territories have been announced by Dewey and Almy Chemical Division, W R Grace & Co, Cambridge, Mass.

Glenn D Jackson III, who was formerly responsible for Georgia and Florida, now will serve Pennsylvania, Maryland, Delaware, and Virginia. He has moved to Wayne, Pa.

Billy E McCardle, formerly responsible for Texas, Oklahoma, Louisiana, Arkansas, Mississippi and western Tennessee, assumes responsibility for Florida, Georgia, Alabama, and eastern Tennessee. He has moved to Decatur, Ga. His former territory has been occupied by *William C Capehart*, whose appointment to Dewey and Almy was recently announced.

GENERAL CALENDAR OF COMING EVENTS

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, TEXTILE ENGINEERING DIVISION
Nov 1-2 (Annual Meeting———Massachusetts Institute of Technology, Cambridge, Mass); Apr 11-13 (Spring Meeting———North Carolina State College, Raleigh, NC)

CHICAGO SECTION, AMERICAN CHEMICAL SOCIETY
Sept 5-8 (11th National Chemical Exposition———Chicago Amphitheatre, Chicago, Ill)

FIBER SOCIETY
April 11-13 (North Carolina State College, Raleigh, NC)

INTERNATIONAL TEXTILE MACHINERY EXPOSITION
Sept 1962 (3rd Exposition, Hannover, Germany)

NARROW FABRICS INSTITUTE, INC
Nov 13-15 (Statler-Hilton, New York, NY)

NATIONAL COTTON COUNCIL OF AMERICA
Nov 8-9 (1961 Chemical Finishing Conference———Sheraton Park Hotel, Washington, DC); Oct 3-4, 1962 (1962 Chemical Finishing Conference———Sheraton Park Hotel, Washington, DC)

NATIONAL RETAIL MERCHANTS ASSOCIATION
May 20-23 (Fibers, Fabrics and Finishes Exposition———New York Trade Show Bldg, New York, NY)

SCHWEIZERISCHER VEREIN DER CHEMIKER-COLORISTEN
October 12-14 (Symposium on "Permanent Finishing 1961"——— Swiss Federal Institute of Technology, Zurich, Switzerland)

SYNTHETIC ORGANIC CHEMICAL MANUFACTURERS ASSOCIATION OF THE UNITED STATES
Sept 12, Oct 10, Nov 14 (Luncheon Meetings———Palm Terrace Suite, Hotel Roosevelt, New York, NY); Dec 7 (Annual Meeting and Dinner———Hotel Roosevelt, New York, NY)

UNION OF PURE AND APPLIED CHEMISTRY
July 27-Aug 1 (International Symposium on Macromolecular Chemistry, Queen Elizabeth Hotel, Montreal, Canada)
August 6-12 (18th International Congress of Pure and Applied Chemistry———Montreal, Canada)

WORLD CONGRESS FOR MAN-MADE FIBERS
May 15-18, 1962 (2nd World Congress, London, England)

ADR ABSTRACTS

New Profit Clues in Industrial Fabrics

Hoffman, W E, *Modern Textiles 41*, 63-70, Nov, 1960

Man-made fibers continue to make progress in the area of industrial end-uses for fabrics.

One of the latest uses for synthetic fabrics has been their application in the building-construction field. The so-called "air house", made by Seattle Tent & Awning Co, is a dome-like structure made from nylon fabric coated with Geon vinyl resin, which surrounds a construction project and, supported solely by air pressure, permits an inside temperature to be maintained as high as 40° above that of the outside air, thus making the workers independent of weather conditions. The same principle is used to cover outdoor swimming pools. A portable heater furnishes the interior heat and also supplies air pressure to support the structure.

Vinyl-coated nylon, made by Herculite Protective Fabrics, has high tear strength, great durability and light weight, combined with waterproofness. It finds uses in tarpaulin applications, eg, on open trucks.

An uncoated tent cloth woven of Du Pont Type 300 nylon is said to possess both air permeability and resistance to water penetration.

A neoprene-coated nylon fabric with high abrasion resistance has been developed by U S Rubber Co for truck tarpaulins.

There is a sharp trend toward the use of fire-hose jacketing made from a combination of Dacron and cotton.

Chemically resistant Dynel modacrylic fiber, produced by Union Carbide, is widely used in the filter industry, eg, as filter bags for swimming pools and in the refining of sugar-beet syrup.

Filter bags made of silicone-treated Fiberglas fabric have been used by Bethlehem Steel to overcome the problem of electric furnace fume dust.

An expandable coated fabric has been developed by Goodyear Aircraft Corp for applications in space technology. It must withstand high temperatures, extreme cold, and "the hard vacuum of space".

Neoprene-coated nylon is used for the parachutes which slow down the re-entry of the nose cone of missiles into the atmosphere.

Polypropylene yarns are being used for marine cordage and ropes, according to Industrial Rayon Corp, and are said to have two advantages over other synthetics: lighter weight and no water absorption. They have high strength and abrasion resistance. Polypropylene is also being used in industrial filter cloths and tarpaulins. Meanwhile nylon continues to gain acceptance in the field of ropes and cordage.

Man-made fibers, eg, nylon and high-tenacity rayon, are being widely used in conveyor belts, where the demands for strength and endurance are extraordinary. Several installations are described.

Numerous other industrial applications of fibers are discussed in this comprehensive paper.

●

Stripping of Procion Dyes from Cotton for Investigation of Faults

Nevell, T P, *J Soc Dyers & Col 77*, 158-60, April 1961

One of the chief virtues of reactive dyes (eg, Procion dyes) is that they combine chemically with the fiber being dyed. However, if it becomes necessary to remove the dye from the fiber, this virtue becomes a vice because a covalent bond has to be broken.

For example, it is frequently necessary to determine the fluidity of the fabric. This is impossible with many Procion-dyed materials (particularly those dyed with the cold-dyeing dyes) because they are insoluble in cuprammonium hydroxide solution and other solvents for cellulose. It is also sometimes necessary to strip fabric completely so that it can be redyed under carefully controlled conditions.

Existing methods for stripping Procion dyes are inadequate for either of these purposes. The method employing hot acetic or formic acid is liable to affect the fluidity that is to be measured, and stripping with alkaline hydrosulfite merely destroys the azo linkage of the dye without affecting the linkage between the triazine ring and cellulose.

The Procion dyes, with one exception (Brilliant Blue H7G) are said to be triazine derivatives, containing either two atoms or one atom of reactive chlorine. These chlorine atoms form linkages with hydroxyl groups in the cellulose. The problem was to find a reagent which would break this bond without degrading the cellulose.

Boiling with aqueous sodium carbonate solution was found to hydrolyze sufficient cross-linkages in Procion dyeings to render them soluble in cuprammonium hydroxide. Little dye was removed from the cloth, however, and another reagent was needed for complete stripping of the dye. Hot aqueous hydrazine was found to be extremely effective; all the dyes except Procion Brilliant Blue H7G were completely stripped by boiling in 40% hydrazine for three hours, and the cloth could be redyed perfectly evenly with the same dye. (The one exception, Blue H7G, was partially stripped.)

It has been reported that, when the color of cotton dyed with certain Procion dyes is partially destroyed by means of alkaline hydrosulfite, the presence on the cotton of an organic molecule containing an amino group can be demonstrated by the deep color developed when the reduced dyeing is diazotized and coupled with β-naphthol. By contrast, when these dyes have been stripped with hydrazine, no color is produced by the β-naphthol treatment. Apparently the linkage with the cellulose molecule is broken by the hydrazine.

Six references to the literature are cited.

●

Backing, Coating and Bonding with Rubber Latex

Cook, P G, *Can Textile J 78*, 53-7, April 14, 1961

Rubber in latex form is used on the backs of carpets and upholstery, as a coating for rainwear and industrial protective clothing, as a binder for nonwoven fabrics, for double texture goods, and for flock to produce artificial suede.

In the form of foam sponge it is bonded to or produced directly on carpets and automotive fabrics. Again, it shows up as a vital part of the binder in pigment printing.

Natural rubber latex, which is a form of polyisoprene, is obtained directly from the rubber tree, *Hevea Brasiliensis*. Synthetic rubber latices are produced by emulsion polymerization of reactive monomers such as butadiene and styrene.

To show how this phase of the rubber industry has grown, in 1956 over 80 million dry pounds of polymer were used in the U S for textile applications. Seventeen million pounds were natural rubber and the rest synthetic.

Vulcanized natural rubber as a coating gives a high coefficient of friction, and it is being used on the backs of rugs and carpets as a nonskid treatment. Copper and manganese have to be carefully avoided, as they cause the rubber to oxidize and become hard and brittle. The butadiene-styrene (SBR) types of synthetic rubber are less affected by these metals.

In the past, natural rubber latex has been used for coating fabrics to make rainwear, as a backing for pile fabrics used in upholstery, and in many other fabric adhesive applications. Today, these products utilize synthetics because of better resistance to abrasion, to oils and solvents, and to oxidation. Natural rubber is still used to a considerable extent, alone or blended with SBR, to make latex foam, which may be applied directly to fabrics or preformed and then adhered to the fabric later.

The SBR latices, now being used in greater quantity than natural rubber, and formerly known as "GRS" latex, include all copolymer latices of butadiene and styrene where at least 50 percent of the monomer used is butadiene. Copolymers higher in styrene are commonly called "resin latices".

The resin latices contain from 50 to 100 percent of styrene. Where there is only 20 percent of butadiene or less, the latex is used to blend with softer types to impart stiffness.

Other types of latex discussed by the author include nitrile latex, sold under various names (eg, "Buna N") and used for specialty applications (eg, for nonwovens and for coating industrial clothing); Neoprene, which is durable and serviceable under extreme temperature conditions; and various vinyl compounds.

The author gives much information on the practical application of these various products.

The Procion-Resin Process

Rattee, I D, *Dyer 125, 660-1, May 5, 1961*

The author states that the development of techniques for dyeing cellulose by chemical reaction between dyes and the fiber has stimulated tremendous interest. This advance in the field of dyeing has its parallel in the field of textile finishing, where so-called "reactant" resin finishes are being used for durable crease-resists.

Work of the ICI Dyestuff Division has shown that there is a distinct possibility of bringing these two developments together to produce a fast coloration and a durable crease-resist finish in a single process. In this system, reactive dye would not react with the fiber but with the resin finish, which in turn would form the bond with the fiber.

A padding liquor which combines the two functions contains selected Procion dyes, a resin precondensate (eg, a cyclic urea or melamine derivative); a special catalyst, "Procion Resin Catalyst A" (ICI); an anti-migration product, "Perminal PP" (ICI); and a lubricant, "Velan NW" (ICI). The fabric is padded with this formula, dried, and baked in the usual way (over 140°C). It is finally washed to remove unfixed dye.

Using the durable resin finishes, this Procion-Resin process gives excellent dye fixation (90-100%, according to the author), and thereby shows considerable economy in color consumption. By using selected dyes, good lightfastness is obtained, and the fastness to laundering is said to be excellent.

The author cautions that the process may be used only on cotton, since sufficiently durable finishing agents for rayon are lacking.

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Advertisements in this section are restricted to HELP WANTED — POSITION WANTED — EQUIPMENT wanted or for sale. Rates, effective February 1, 1951; one-time, $14.00 per column inch; 13 or more times, $12.00 per column inch; Position Wanted, $4.00 per column inch. Figure 38 average words per column inch. Publisher reserves the right to reject or discontinue any classified advertisement. Replies should be addressed: Box Number ..... c/o American Dyestuff Reporter, 44 East 23rd Street, New York 10, N. Y.

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CAREER OPPORTUNITY—for recent textile school or textile chemistry graduate age 21-24. The man we are looking for should have a friendly, outgoing personality and be interested in the idea of a sales career—even though he may not be heading in that direction now. Thorough training program, good salary and benefits, excellent growth possibilities—New York area. Replies held in strictest confidence. Our employees know of this advertisement. Write Box No. 141

WANTED: TEXTILE COLORIST to supervise and direct coloristic work of large laboratory staff—Leading dyestuff company in vicinity of New York City. Excellent opportunity for initiative, imaginative personality with broad laboratory and practical experience in textile dyeing. Your inquiry will be held in strictest confidence. Write Box No. 175

WANTED: SALESMAN—Spencer Chemical Company is seeking an experienced chemical salesman to join its expanding Industrial Chemicals Division. This man should have a minimum of three years heavy industrial chemicals sales experience and preferably have a technical degree in the chemical field. Sales experience in chemicals, latices to resin paint and textile manufacturers also of interest. Excellent opportunity of future growth. Please send resume of experience, education, and salary requirements to: Personnel Manager, SPENCER CHEMICAL COMPANY, 1004 Baltimore Avenue, Kansas City 5, Missouri.

• OPPORTUNITIES AVAILABLE •

WANTED: SALES REPRESENTATIVES (2)—If you are interested in selling colors and chemicals to the paper industries, we want to talk with you about a position on our sales staff. Experience in this type of work would be a plus value, but most important is knowledge of the field and a strong desire to sell. We offer salary, incentive and an excellent benefit program. If you are interested, contact T. F. O'Brien, SANDOZ, INC., 61 Van Dam Street, New York 13, N. Y.

WANTED: EXPERIENCED SALESMAN to cover established New England territory, for progressive textile specialty firm carrying a complete line of chemicals. Products include the most advanced softeners, resins, sizings, detergents, sequestrants, etc. Liberal salary, commission and expenses. Replies held in strictest confidence. Write Box No. 173

WANTED: CHEMIST FOR TEXTILE CHEMICAL SPECIALTY MANUFACTURER. Must have experience in analysis and development. Excellent opportunity with progressive company. Salary commensurate with experience and ability. Write Box No. 179

WANTED: TEXTILE APPLICATIONS CHEMIST—To conduct research in the laboratory development of new or improved textile auxiliaries with the opportunity to perform technical service during the introduction of new products or processes. Position requires B. S. in Chemistry or equivalent training with good background in organic synthetics. 2 to 5 years of experience in textile chemistry essential with background of mill experience in application of resins, bleaches, etc. to cotton, rayon and wool. Send resume to Supervisor of Technical Placement, HOOKER CHEMICAL CORPORATION, Niagara Falls, New York.

• OPPORTUNITIES AVAILABLE •

WANTED: EXPERIENCED SUPERVISOR for processing and finishing of tubular knit goods. Eventual placement will be in the South. Write Box No. 166

WANTED: PRINT SUPERINTENDENT—Experienced with all types of synthetic fabrics. Must have good knowledge of the coloring and mechanical end, as well as directing personnel and production. Write Box No. 177

WANTED: LABORATORY MANAGER AND TEXTILE CHEMIST for sales service laboratory of large nationally known N. E. textile resin and specialty manufacturer. Laboratory and plant experience in finishing desirable. Excellent opportunity for qualified personnel. Send resume and salary requirements. Write Box No. 178

OPPORTUNITY—DYER OR COLORIST—We have a position open that offers the person qualified an exceptional opportunity to supervise our straw dye and bleach department. He should preferably have a degree of Bachelor of Textile Chemistry. He will be trained for three to six months in our New England factory and then transfer to our Southern plant. We are currently expanding and are constructing new facilities. Excellent working conditions, excellent fringe benefits, excellent starting salary. Send resume to Box No. 180.

• PERSONNEL AVAILABLE •

POSITION WANTED: TEXTILE CHEMIST, B.S. Degree, Age 34. Experience: Application research, product development, product improvement, production control in dyeing, printing and finishing of woven, nonwoven and industrial fabrics. Desires responsible job in East or Midwest. Write Box No. 168

POSITION WANTED: Twenty five years experience as superintendent of dyeing and finishing all types of fabric including all types of tricot. Desire opportunity with fiber manufacturer to make full use mill experience in technical service. Write Box No. 174

POSITION WANTED: TEXTILE TECHNOLOGIST—CHEMIST. Ph. D., fifteen years experience in research, development, mill practice, sales service, administration. Special knowledge of pile fabrics, resins and elastomers, non-wovens, synthetic fiber applications. Write Box No. 176

POSITION WANTED: TEXTILE CHEMIST, B. S. degree. Age 33. Experience: Technical sales-demonstrator, production and development in dyeing, finishing and printing natural fibers, synthetics and blends. Excellent references. Interested in technical sales service or responsible technical or administrative position. Write Box No. 181

POSITION WANTED: PIGMENT CHEMIST available. Experienced in manufacturing oil phase and water phase color concentrates. Can save print works $15,000.00 per machine per year with very small investment. Products currently in use. Write Box No. 182

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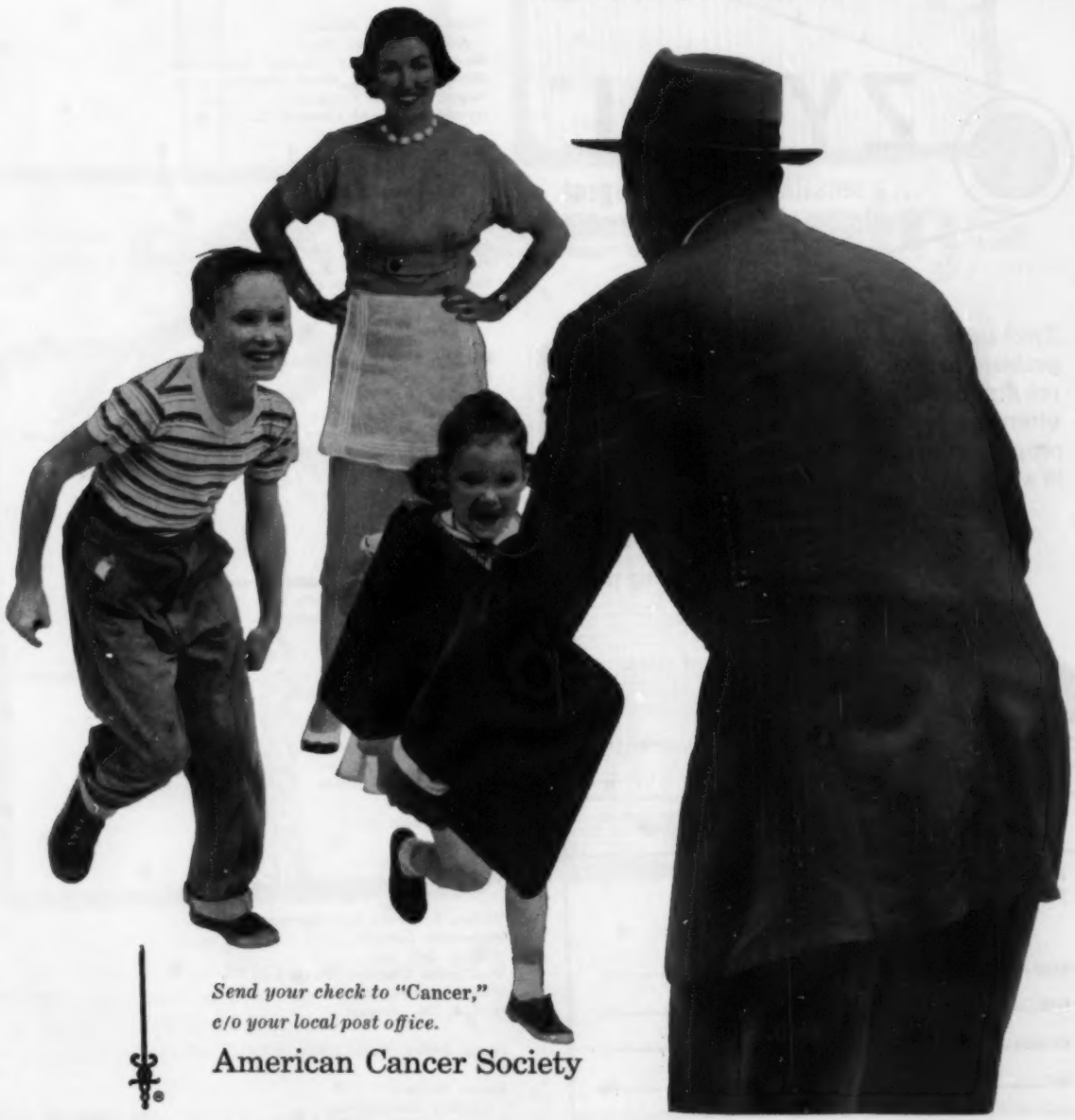

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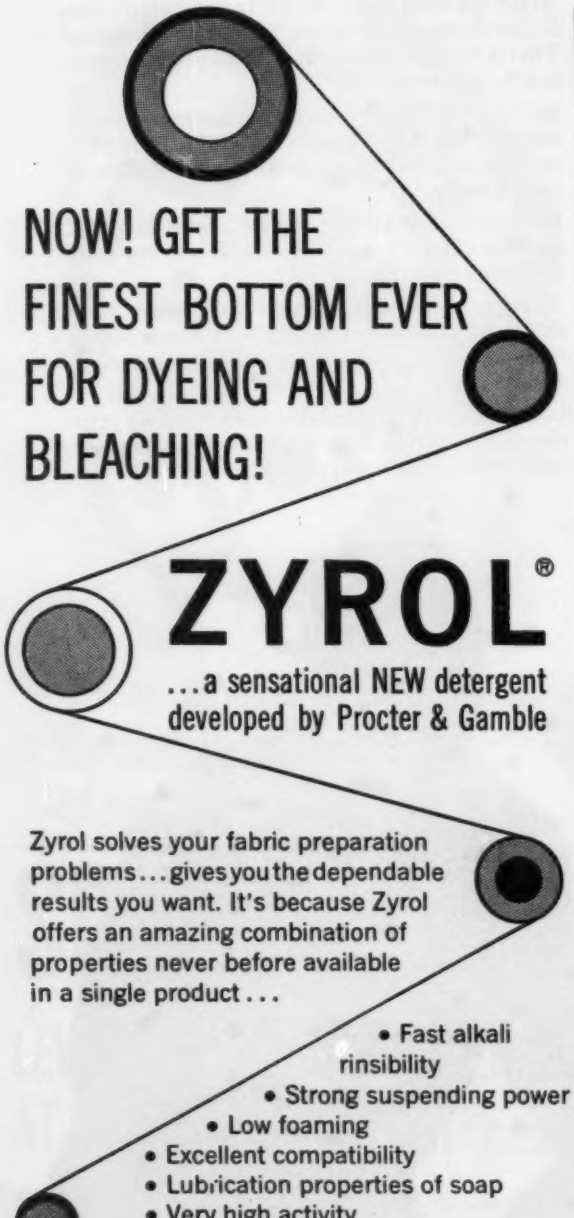

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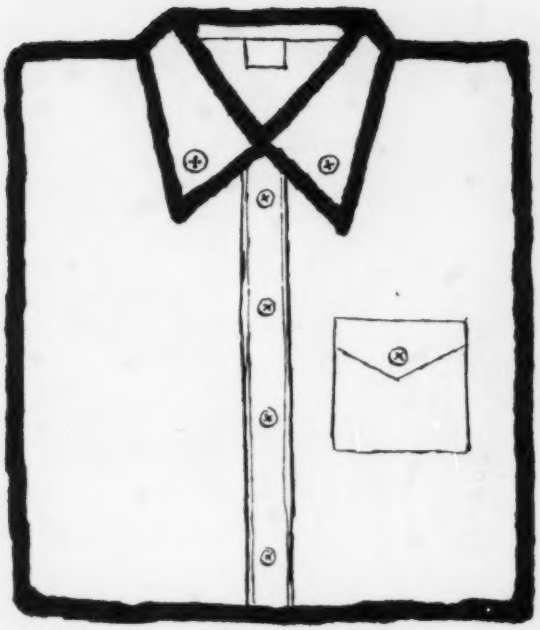

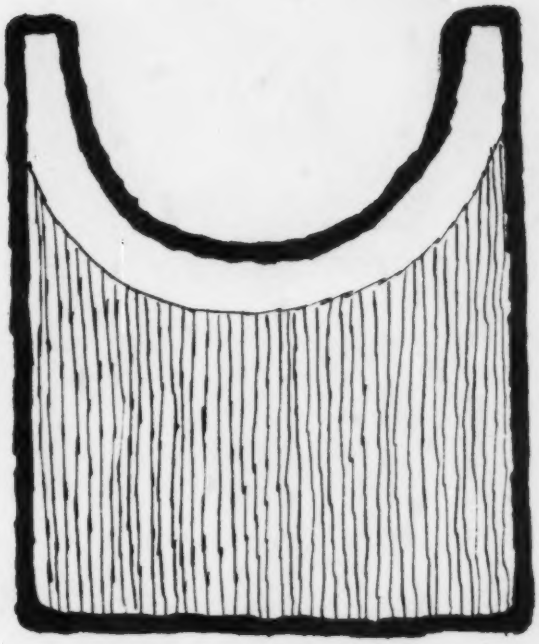

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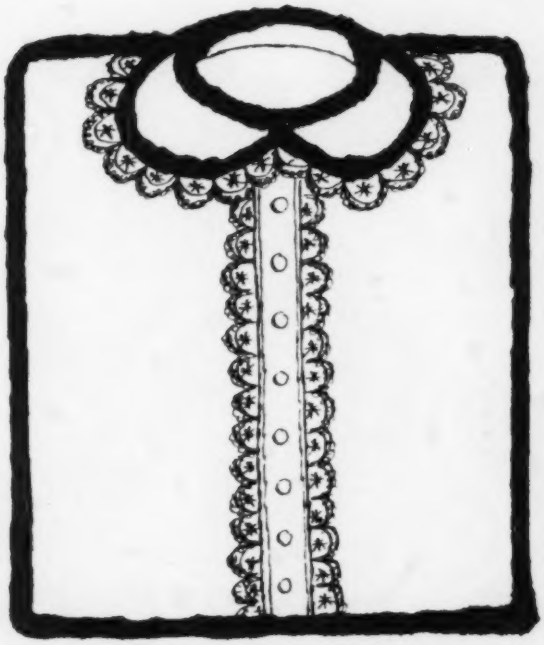

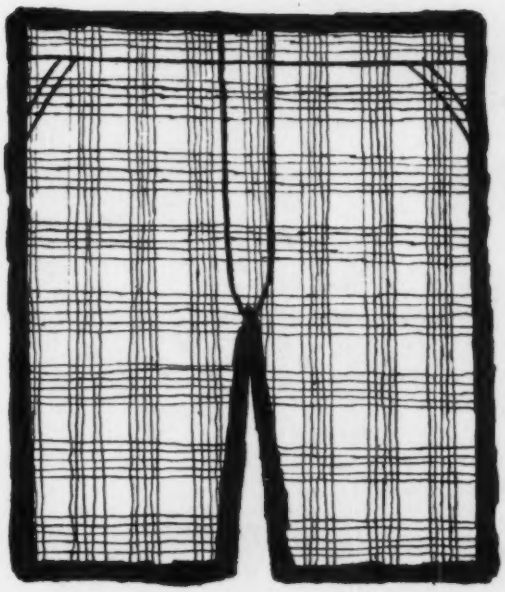

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